Anatomy: Leg and Foot



Question 1 of 110

A 21 year old man presents to ED complaining of numbness over the dorsum of his left foot and inability to dorsiflex or evert his foot. He has had a knee-high plaster cast on his left leg for the past 5 weeks. Which of the following is the most likely site of nerve compression that has resulted in his symptoms:

a Popliteal fossa

b Lateral compartment of leg

c Anterior compartment of leg

d Neck of fibula

e Medial malleolus

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Question 1 of 110

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a) Popliteal fossa
b) Lateral compartment of leg
c) Anterior compartment of leg
d) **Neck of fibula** ✔
e) Medial malleolus

Answer

Dorsiflexion and eversion of the foot are primarily produced by the anterior compartment and the lateral compartment of the leg, innervated by the deep fibular nerve and the superficial fibular nerve respectively. Sensation over the dorsum of the foot is primarily supplied by the superficial fibular nerve. The common fibular nerve is susceptible to injury where it wraps around the neck of the fibula when passing from the popliteal fossa into the leg. This may occur by impact injuries, fractures to the bone or leg casts that are placed too high.

Notes

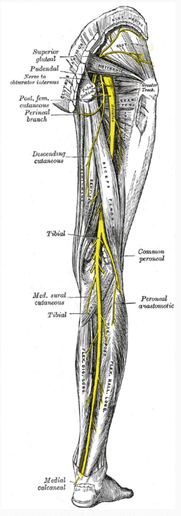
The common fibular nerve is a branch of the sciatic nerve receiving fibres from L4 – S2.

Nerve	Common fibular nerve
Nerve roots	L4 – S2
Motor supply	Short head of the biceps femoris, all muscles in the anterior and lateral compartments of the leg, all intrinsic dorsal foot muscles
Sensory supply	Skin over the lateral aspect of leg and ankle, and dorsal aspect of the foot and toes (except for the lateral side of little toe)
Motor loss in injury	Loss of dorsiflexion of ankle and foot eversion, weakness of foot inversion, loss of toe extension, foot drop with high-stepping gait and loss of sensation in above distribution

Anatomical course

The nerve arises at the apex of the popliteal fossa and follows the medial margin of the biceps femoris tendon over the lateral head of the gastrocnemius muscle. Here it gives rise to two cutaneous branches, the sural communicating nerve which joins the sural nerve (branch of the tibial nerve), and the lateral sural cutaneous nerve (supplying skin over the upper lateral leg).

The common fibular nerve continues by wrapping around the neck of the fibula and passing between the attachments of the fibularis longus muscle to enter the lateral compartment of the leg where it divides into its terminal branches, the superficial and deep fibular nerves.



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Function

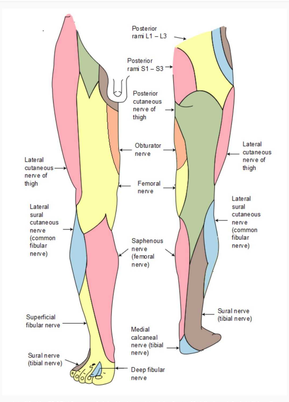
The common fibular nerve directly innervates the short head of the biceps femoris muscle and supplies skin over the upper lateral leg via its lateral sural cutaneous branch. Through its terminal branches, the common fibular nerve innervates all of the muscles in the anterior and lateral compartments of the leg and the dorsal intrinsic foot muscles and skin over the anterolateral aspect of the lower leg and the dorsal aspect of the foot and toes (except for the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Branch	Innervation
Muscular branch	Short head of biceps femoris muscle
Sural communicating nerve	Joins sural nerve
Lateral sural cutaneous nerve	Skin over upper lateral leg
Superficial fibular nerve	Lateral compartment of leg and skin over lower anterolateral leg, and dorsum of foot (except lateral side of little toe and skin over webspace of 1st and 2nd toe)
Deep fibular nerve	Anterior compartment of leg and skin over webspace between 1st and 2nd toes

Motor supply

Muscle	Action(s)	Innervation
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch	Superficial fibular nerve (L5 – S2)
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)

Sensory supply



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Anatomy: Leg and Foot



Question 2 of 110

Which of the following clinical features would you NOT expect to see in a tibial nerve palsy:

a Loss of plantarflexion of the foot

b Loss of flexion of the toes

c Weakened eversion of the foot

d Weakened inversion of the foot

e Loss of sensation over sole of the foot

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Question 2 of 110

Which of the following clinical features would you NOT expect to see in a tibial nerve palsy:

a) Loss of plantarflexion of the foot
b) **Loss of flexion of the toes** ✘
c) Weakened eversion of the foot ✔
d) Weakened inversion of the foot
e) Loss of sensation over sole of the foot

Answer

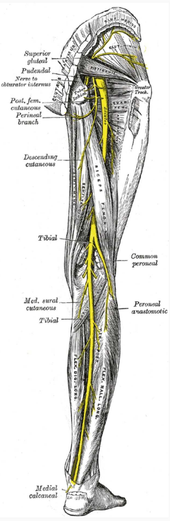
Damage to the tibial nerve results in loss of plantarflexion of the ankle and weakness of inversion of the foot resulting in a shuffling gait, clawing of the toes and loss of sensation in its cutaneous distribution.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

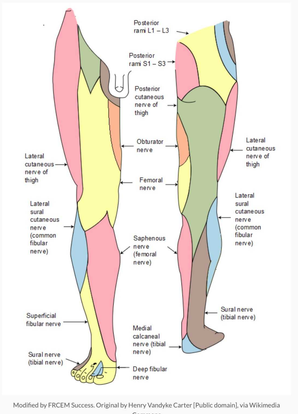


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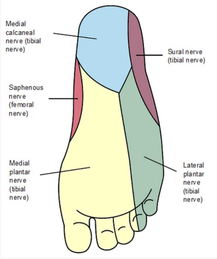
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 3 of 110

The fibularis brevis muscle acts to produce which of the following movements:

a Plantarflexion and inversion of the foot

b Plantarflexion and eversion of the foot

c Dorsiflexion and eversion of the foot

d Inversion alone

e Eversion alone

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Anatomy: Leg and Foot

Question 3 of 110

The fibularis brevis muscle acts to produce which of the following movements:

a) Plantarflexion and inversion of the foot
b) **Plantarflexion and eversion of the foot** ✖
c) Dorsiflexion and eversion of the foot
d) Inversion alone
e) Eversion alone ✔

Answer

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

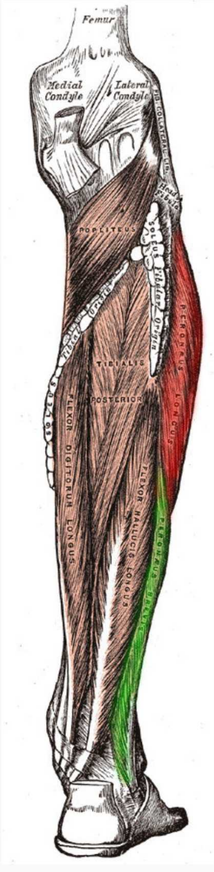
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 4 of 110

The common fibular nerve directly innervates which of the following muscles:

a Rectus femoris

b Biceps femoris

c Gracilis

d Semitendinosus

e Semimembranosus

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Anatomy: Leg and Foot



Question 5 of 110

A 23 year old professional footballer is brought to hospital after injuring his left leg in a tackle, where lateral force was applied to his extended leg. The patient complains of pain in the medial knee after you apply valgus stress on the knee. You suspect injury to the tibial collateral ligament. Which of the following structures would most likely also be injured due to its attachments:

a Anterior cruciate ligament

b Posterior cruciate ligament

c Medial meniscus

d Lateral meniscus

e Patella

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Question 5 of 110

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a) Anterior cruciate ligament
b) Posterior cruciate ligament
c) **Medial meniscus** ✔
d) Lateral meniscus
e) Patella

Answer

The medial meniscus is attached firmly to the tibial collateral ligament, and any damage to this ligament often causes damage to the medial meniscus.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

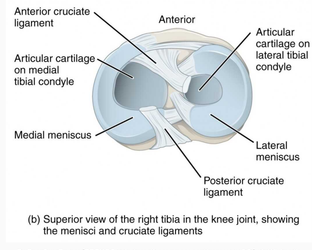
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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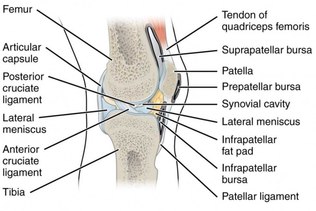
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 6 of 110

The skin over the upper lateral leg is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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The skin over the upper lateral leg is primarily supplied by which of the following nerves:

a) Sural nerve
b) **Common fibular nerve** ✔
c) Tibial nerve
d) Saphenous nerve
e) Superficial fibular nerve

Answer

The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.

Notes

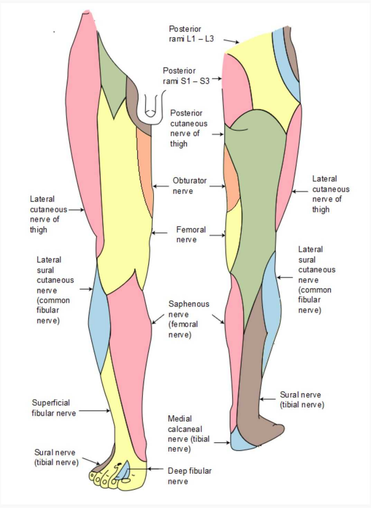
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

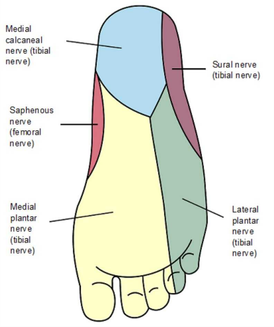
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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While performing an examination of a 40 year old male patient who complains of pain in his foot, you notice an abnormality. His foot is displaced laterally and everted, and the head of the talus is no longer supported. A image of his foot is shown below. Which of the following ligaments is most likely to be stretched in this patient:



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a Short plantar ligament

b Long plantar ligament

c Spring ligament

d Calcaneofibular ligament

e Anterior talofibular ligament

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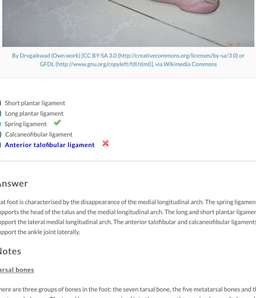
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Anatomy: Leg and Foot

Question 7 of 110

While performing an examination of a 40 year old male patient who complains of pain in his foot, you notice an abnormality. His foot is displaced laterally and everted, and the head of the talus is no longer supported. A image of his foot is shown below. Which of the following ligaments is most likely to be stretched in this patient:



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a) Short plantar ligament
b) Long plantar ligament
c) Spring ligament ✔
d) Calcaneofibular ligament
e) **Anterior talofibular ligament** ✘

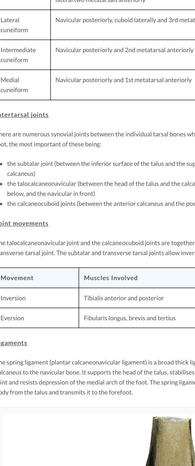
Answer

Flat foot is characterised by the disappearance of the medial longitudinal arch. The spring ligament supports the head of the talus and the medial longitudinal arch. The long and short plantar ligaments support the lateral medial longitudinal arch. The anterior talofibular and calcaneofibular ligaments support the ankle joint laterally.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

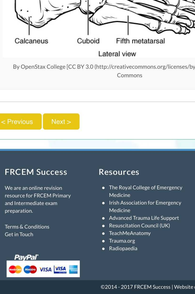
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.

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Anatomy: Leg and Foot



Question 8 of 110

The tibialis posterior distally inserts mainly onto which of the following bones:

a Medial cuneiform and 1st metatarsal

b Navicular and medial cuneiform

c Medial and intermediate cuneiform

d Navicular and all three cuneiforms

e 1st metatarsal

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The tibialis posterior distally inserts mainly onto which of the following bones:

a) **Medial cuneiform and 1st metatarsal** ✗
b) Navicular and medial cuneiform ✓
c) Medial and intermediate cuneiform
d) Navicular and all three cuneiforms
e) 1st metatarsal

Answer

The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

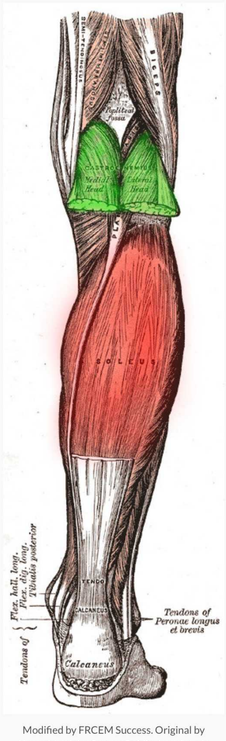
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

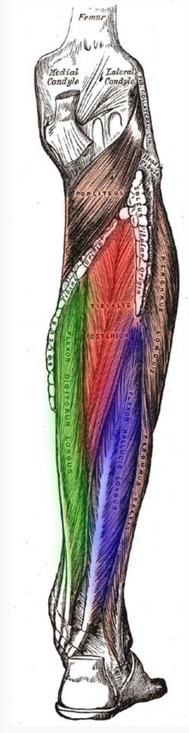
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 9 of 110

The fibularis tertius muscle is innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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Regarding the menisci, which of the following statements is CORRECT:

a The menisci are C-shaped bony structures attaching at each end to the tibial plateaus.

b The menisci lie between the patella and the anterior femur.

c The medial meniscus is attached to the tibial collateral ligament.

d The medial meniscus is the smaller, more mobile of the two.

e The lateral meniscus is attached to the fibular collateral ligament.

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Regarding the menisci, which of the following statements is CORRECT:

a) The menisci are C-shaped bony structures attaching at each end to the tibial plateaus.
b) The menisci lie between the patella and the anterior femur.
c) **The medial meniscus is attached to the tibial collateral ligament.** ✔
d) The medial meniscus is the smaller, more mobile of the two.
e) The lateral meniscus is attached to the fibular collateral ligament.

Answer

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus (which does NOT attach to the fibular collateral ligament).

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

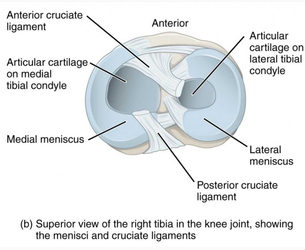
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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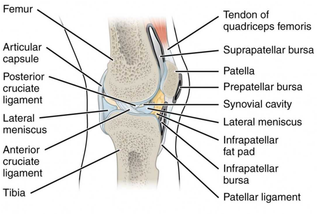
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 11 of 110

A patient presents to the ED complaining of lower back pain. You perform a neurological examination and note paraesthesia in the L4 dermatome. The L4 dermatome is best tested at which of the following landmarks:

a At the medial femoral condyle

b At the lateral femoral condyle

c At the fibular head

d Over the medial malleolus

e Over the lateral malleolus

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a) At the medial femoral condyle
b) At the lateral femoral condyle
c) At the fibular head
d) **Over the medial malleolus** ✔
e) Over the lateral malleolus

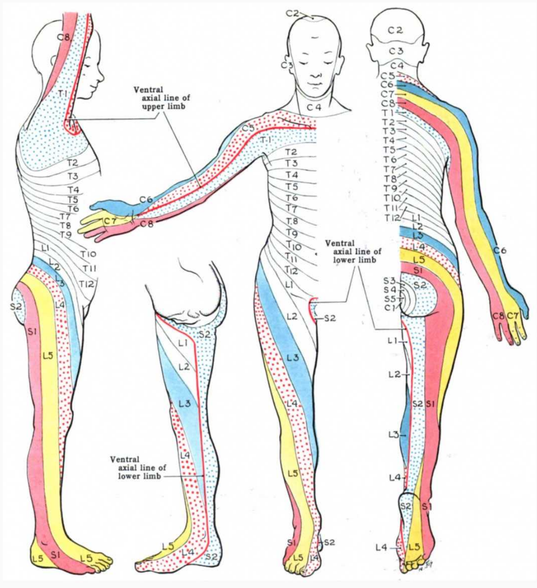
Answer

The L4 dermatome is best tested over the medial malleolus.

Notes

Dermatome	Landmark
L1	Upper Anterior Thigh
L2	Mid Anterior Thigh
L3	Medial Femoral Condyle
L4	Medial Malleolus
L5	Dorsum 3rd MTP Joint
S1	Lateral Heel
S2	Popliteal Fossa
S3	Ischial Tuberosity
S5	Perianal Area

- The T12 dermatome is best tested at the midclavicular line, over the midpoint of the inguinal ligament.
- The L1 dermatome is best tested on the upper anterior thigh, at a point midway between the key sensory points for T12 and L2.
- The L2 dermatome is best tested on the anteromedial thigh, at the midpoint drawn on an imaginary line connecting the midpoint of the inguinal ligament and the medial femoral condyle.
- The L3 dermatome is best tested at the medial femoral condyle above the knee.
- The L4 dermatome is best tested over the medial malleolus.
- The L5 dermatome is best tested on the dorsum of the foot at the third metatarsophalangeal joint.
- The S1 dermatome is best tested on the lateral aspect of the calcaneus.
- The S2 dermatome is best tested at the midpoint of the popliteal fossa.
- The S3 dermatome is best tested over the ischial tuberosity or infragluteal fold (depending on the patient their skin can move up, down or laterally over the ischii).
- The S4/S5 dermatome is best tested in the perianal area, less than one cm lateral to the mucocutaneous junction.



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The popliteus muscle is innervated by which of the following nerves:

a Sciatic nerve

b Common fibular nerve

c Superficial fibular nerve

d Deep fibular nerve

e Tibial nerve

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The popliteus muscle is innervated by which of the following nerves:

a) Sciatic nerve
b) Common fibular nerve
c) Superficial fibular nerve
d) Deep fibular nerve
e) **Tibial nerve** ✔

Answer

The popliteus is innervated by the tibial nerve (L4 – S1).

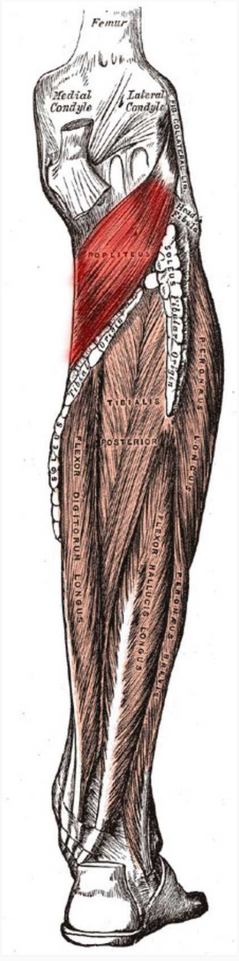
Notes

The popliteus muscle is the smallest and most superior of the deep muscles in the posterior compartment of the leg.

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint. It stabilises the knee by resisting lateral rotation of the tibia on the femur.

The popliteus muscle is also attached to the lateral meniscus in the knee and draws it posteriorly during knee flexion thus preventing its entrapment.

The popliteus is innervated by the tibial nerve (L4 – S1).



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The superficial fibular nerve innervates which of the following muscles:

a Fibularis brevis

b Fibularis tertius

c Tibialis anterior

d Extensor hallucis longus

e Tibialis posterior

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The superficial fibular nerve innervates which of the following muscles:

a) **Fibularis brevis** ✔
b) Fibularis tertius
c) Tibialis anterior
d) Extensor hallucis longus
e) Tibialis posterior

Answer

The superficial fibular nerve innervates the fibularis longus and fibularis brevis muscles in the lateral compartment of the leg.

Notes

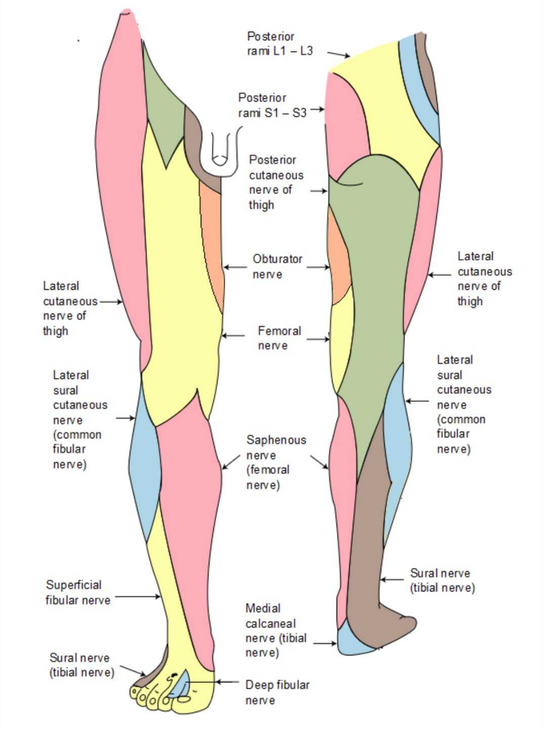
The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Nerve	Superficial fibular nerve
Nerve roots	L4 – S1
Motor supply	Lateral compartment of leg
Sensory supply	Lower anterolateral leg and dorsum of foot
Injury	Loss of eversion of the foot and loss of sensation over the lower anterolateral leg and dorsum of foot

It innervates the fibularis longus and the fibularis brevis in the lateral leg. It supplies the skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd digit supplied by the deep fibular nerve, and the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Motor supply

Muscle	Action(s)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch
Fibularis brevis	Eversion of foot



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Question 14 of 110

Which of the following knee bursae typically communicates with the synovial cavity of the knee joint:

a Subcutaneous infrapatellar bursa

b Suprapatellar bursa

c Deep infrapatellar bursa

d Prepatellar bursa

e Pretibial bursa

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Which of the following knee bursae typically communicates with the synovial cavity of the knee joint:

a) Subcutaneous infrapatellar bursa
b) **Suprapatellar bursa** ✔
c) Deep infrapatellar bursa
d) Prepatellar bursa
e) Pretibial bursa

Answer

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

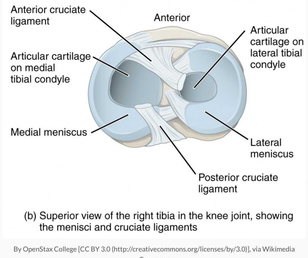
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anteralaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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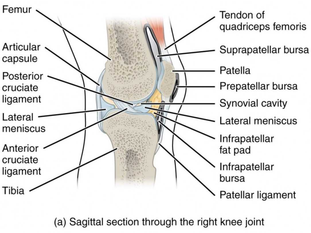
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 15 of 110

The fibularis longus muscle attaches distally to which of the following structures:

a Intermediate cuneiform

b Base of 1st metatarsal and medial cuneiform

c Base of 5th metatarsal and lateral cuneiform

d Navicular

e Base of 5th metatarsal

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The fibularis longus muscle attaches distally to which of the following structures:

a) Intermediate cuneiform
b) **Base of 1st metatarsal and medial cuneiform** ✔
c) Base of 5th metatarsal and lateral cuneiform
d) Navicular
e) Base of 5th metatarsal

Answer

The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.

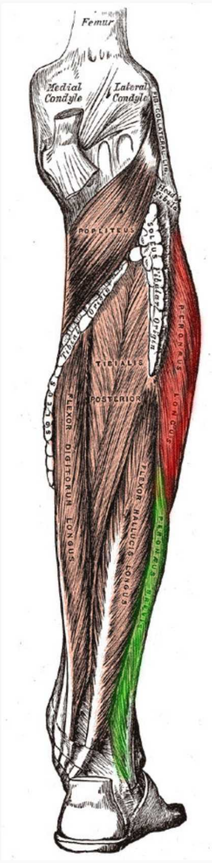
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 16 of 110

Eversion of the foot is primarily produced by which of the following muscles:

a Fibularis longus, brevis and tertius

b Tibialis anterior and tibialis posterior

c Tibialis anterior and fibularis longus

d Tibialis posterior and fibularis longus

e Fibularis longus and fibularis tertius

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Anatomy: Leg and Foot

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Eversion of the foot is primarily produced by which of the following muscles:

a) Fibularis longus, brevis and tertius ✔
b) Tibialis anterior and tibialis posterior
c) Tibialis anterior and fibularis longus
d) Tibialis posterior and fibularis longus
e) Fibularis longus and fibularis tertius

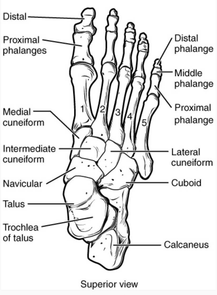
Answer

The subtalar and transverse tarsal joints allow inversion and eversion of the foot. Inversion of the foot is primarily produced by the tibialis anterior and tibialis posterior muscles. Eversion of the foot is primarily produced by the fibularis longus, fibularis brevis and fibularis tertius muscles.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

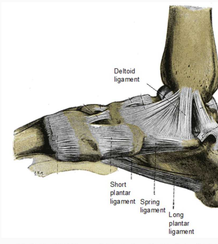
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

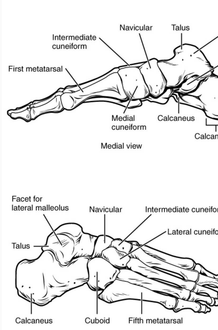
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 17 of 110

A 23 year old tennis player sustains an injury to her leg and is complaining of weakness of dorsiflexion and inversion of her foot. Which of the following muscles is most likely affected:

a Tibialis posterior

b Tibialis anterior

c Fibularis longus

d Fibularis brevis

e Fibularis tertius

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Anatomy: Leg and Foot

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A 23 year old tennis player sustains an injury to her leg and is complaining of weakness of dorsiflexion and inversion of her foot. Which of the following muscles is most likely affected:

a) Tibialis posterior
b) **Tibialis anterior** ✔
c) Fibularis longus
d) Fibularis brevis
e) Fibularis tertius

Answer

The tibialis anterior acts to produce dorsiflexion and inversion of the foot. The tibialis posterior assists in inversion, but acts to produce plantarflexion. The fibularis brevis assists in dorsiflexion but also assists with eversion of the foot. The fibularis longus and fibularis brevis predominantly act to produce eversion of the foot.

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

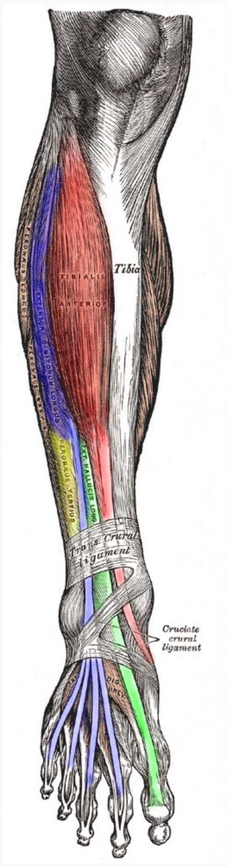
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

The extensor hallucis longus (green) extends the great toe and dorsiflexes the foot at the ankle joint.

The extensor digitorum longus (blue) extends the lateral four toes and dorsiflexes the foot at the ankle.

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



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The ankle joint is formed between which of the following bones:

a Tibia and talus

b Tibia, fibula and talus

c Tibia and calcaneus

d Tibia, fibula and calcaneus

e Tibia, talus and calcaneus

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The ankle joint is formed between which of the following bones:

a) Tibia and talus
b) Tibia, fibula and talus ✔
c) Tibia and calcaneus
d) Tibia, fibula and calcaneus
e) **Tibia, talus and calcaneus** ✖

Answer

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

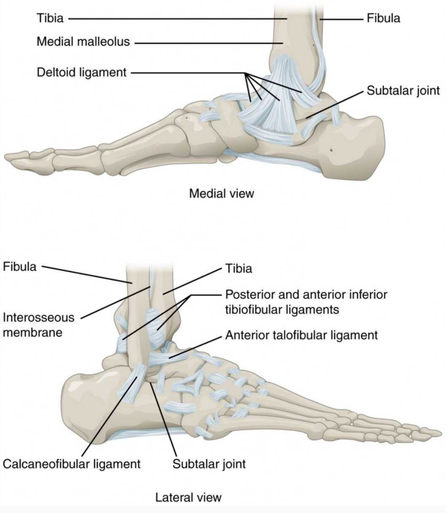
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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A 22 year old man has injured his right foot in an ice-skating accident. X-ray demonstrates an inferior displacement of the head of the talus bone, causing loss of the medial arch of the foot. Which of the following structures has most likely been damaged to allow this to happen:

a Deltoid ligament

b Anterior talofibular ligament

c Posterior talofibular ligament

d Spring ligament

e Long plantar ligament

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A 22 year old man has injured his right foot in an ice-skating accident. X-ray demonstrates an inferior displacement of the head of the talus bone, causing loss of the medial arch of the foot. Which of the following structures has most likely been damaged to allow this to happen:

a) **Deltoid ligament** ✗
b) Anterior talofibular ligament
c) Posterior talofibular ligament
d) Spring ligament ✓
e) Long plantar ligament

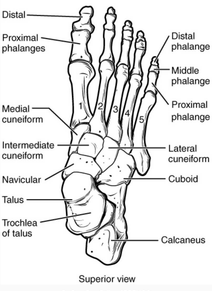
Answer

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

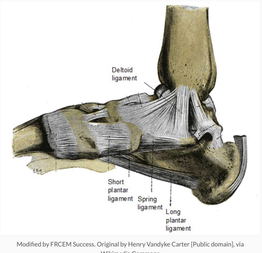
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

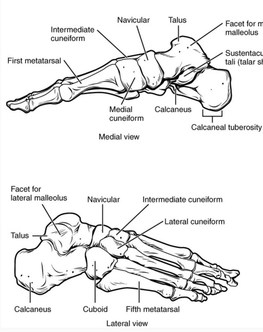
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 20 of 110

A 21 year old professional athlete sustains an inversion injury to her left ankle during the 800m. Which of the following ligaments is most likely injured:

a Anterior talofibular ligament

b Posterior talofibular ligament

c Deltoid ligament

d Long plantar ligament

e Spring ligament

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Anatomy: Leg and Foot



Question 20 of 110

A 21 year old professional athlete sustains an inversion injury to her left ankle during the 800m. Which of the following ligaments is most likely injured:

a) **Anterior talofibular ligament** ✔
b) Posterior talofibular ligament
c) Deltoid ligament
d) Long plantar ligament
e) Spring ligament

Answer

Inversion injuries at the ankle in plantarflexion are common, and typically result in damage to the lateral collateral ligament of the ankle, made up of the anterior talofibular, the calcaneofibular and the posterior talofibular ligaments. The anterior talofibular and the calcaneofibular ligaments are most commonly injured, and the posterior talofibular ligament rarely. The spring ligament supports the head of the talus, the deltoid ligament supports the medial aspect of the ankle joint, and the long and short plantar ligaments are involved in maintaining the lateral longitudinal arch of the foot.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

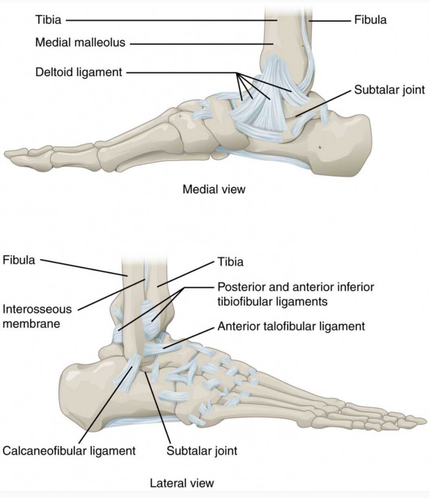
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 21 of 110

The tendons of the tibialis posterior and fibularis longus muscles lie within which of the muscular layers of the sole of the foot:

a Within the first layer

b Within the second layer

c Within the third layer

d Within the fourth layer

e Between the third and fourth layer

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Question 21 of 110

The tendons of the tibialis posterior and fibularis longus muscles lie within which of the muscular layers of the sole of the foot:

a) Within the first layer
b) Within the second layer
c) Within the third layer
d) **Within the fourth layer** ✔
e) Between the third and fourth layer

Answer

The tendons of the tibialis posterior and fibularis longus muscles are part of the fourth layer.

Notes

The muscles in the sole of the foot are organised into four layers. Detailed knowledge of the muscles which lie within a given layer is not required, but the following is required knowledge and has implications for the structures likely to compromised when the sole is injured.

The plantar arteries and nerves lie between the first and second layers.

The long flexor tendons of the flexor hallucis longus and flexor digitorum longus muscles lie within the second layer.

The tendons of the tibialis posterior and fibularis longus muscles are part of the fourth layer.

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Anatomy: Leg and Foot



Question 22 of 110

A 24 year old hockey player presents to hospital having injured her left foot. X-ray demonstrates an avulsion fracture of the tuberosity of the fifth metatarsal. Which of the following muscles is most likely pulling on the fractured fragment:

a Fibularis longus

b Fibularis brevis

c Fibularis tertius

d Tibialis anterior

e Tibialis posterior

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Anatomy: Leg and Foot

Question 22 of 110

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a) Fibularis longus
b) **Fibularis brevis** ✔
c) Fibularis tertius
d) Tibialis anterior
e) Tibialis posterior

Answer

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.

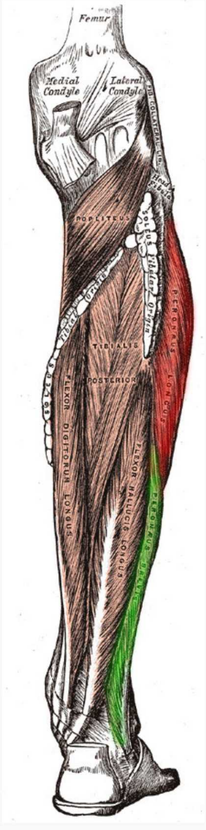
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 23 of 110

A 17 year old man has dislocated his left patella during a rugby match. Which of the following muscles should the physiotherapist focus on in rehabilitation to prevent recurrent dislocations:

a Rectus femoris

b Vastus medialis

c Vastus lateralis

d Sartorius

e Gracilis

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Question 23 of 110

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a) Rectus femoris ✗
b) Vastus medialis ✓
c) Vastus lateralis
d) Sartorius
e) Gracilis

Answer

The patella typically dislocates in a lateral direction. The lower portion of the vastus medialis muscle on the medial thigh inserts upon the medial aspect of the patella and acts to draw the patella in a medial direction (especially in terminal extension). If the vastus medialis muscle is not strong enough, the patella is much more susceptible to dislocation.

Notes

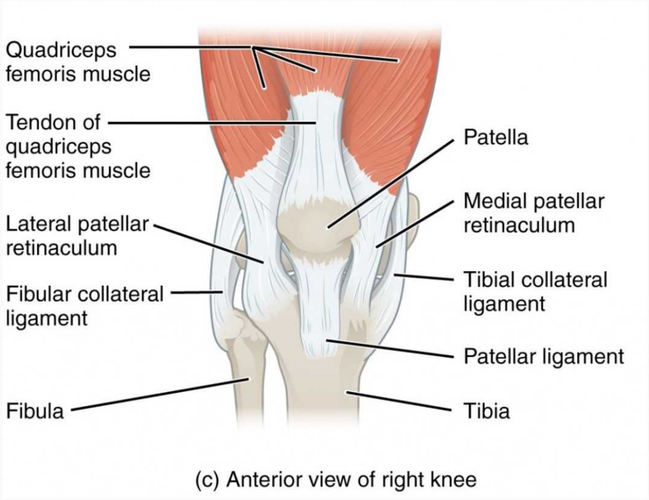
The patella is a sesamoid bone embedded in the quadriceps femoris tendon which sits in the trochlear groove of the anterior femur. The patella acts to magnify the force exerted by the quadriceps femoris and to redirect the quadriceps force as it undergoes normal lateral tracking during flexion.

The medial and lateral patellar retinaculum are formed primarily from fibres of the vastus medialis muscle, and the vastus lateralis muscle and iliotibial tract respectively, and attach the patella margins to surrounding fascia.

There are several structures that work together to keep the patella aligned and stabilised on the femur to prevent excessive lateral movement of the patella:

- The lateral femoral condyle on the lateral aspect of the trochlear groove is normally slightly higher than the medial aspect, providing a buttress to the patella on the lateral side.
- The vastus medialis muscle on the medial thigh acts to draw the patella in a medial direction. If the vastus medialis muscle is not strong enough, the patella is much more susceptible to dislocation.
- The medial patellofemoral ligament, extending from the medial aspect of the patella to the medial femoral condyle, provides a significant force (about 60%) against lateral displacement.

The quadriceps femoris tendon is continuous distally with the patella ligament which is attached to the tibial tuberosity distally.



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Anatomy: Leg and Foot



Question 24 of 110

Regarding the ankle joint, which of the following statements is INCORRECT:

a The talus bone articulates with the tibia in two places.

b The articular surface of the talus is much wider anteriorly than it is posteriorly.

c The ankle joint is more unstable in plantarflexion.

d The majority of ankle injuries occur due to a sudden inversion of the foot.

e The fibula does not articulate with the talus directly, but is bound to the tibia by strong talofibular ligaments.

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Question 24 of 110

Regarding the ankle joint, which of the following statements is INCORRECT:

a) The talus bone articulates with the tibia in two places.
b) The articular surface of the talus is much wider anteriorly than it is posteriorly.
c) **The ankle joint is more unstable in plantarflexion.** ✖
d) The majority of ankle injuries occur due to a sudden inversion of the foot.
e) ✔

The fibula does not articulate with the talus directly, but is bound to the tibia by strong talofibular ligaments.

Answer

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

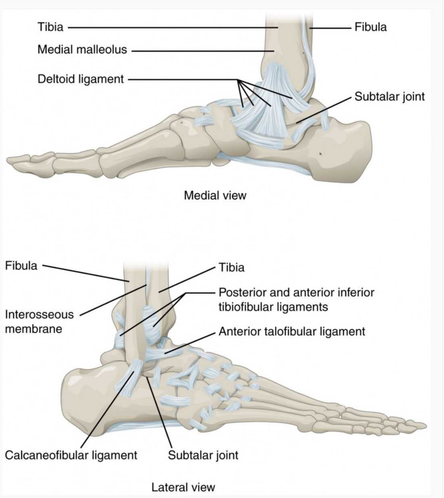
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 25 of 110

The S2 dermatome is best tested at which of the following landmarks:

a Medial malleolus

b Lateral malleolus

c Dorsum of the foot at the third metatarsophalangeal joint

d Midpoint of the popliteal fossa

e Lateral heel

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Anatomy: Leg and Foot

Question 25 of 110

The S2 dermatome is best tested at which of the following landmarks:

a) Medial malleolus
b) Lateral malleolus
c) Dorsum of the foot at the third metatarsophalangeal joint
d) **Midpoint of the popliteal fossa** ✔
e) Lateral heel

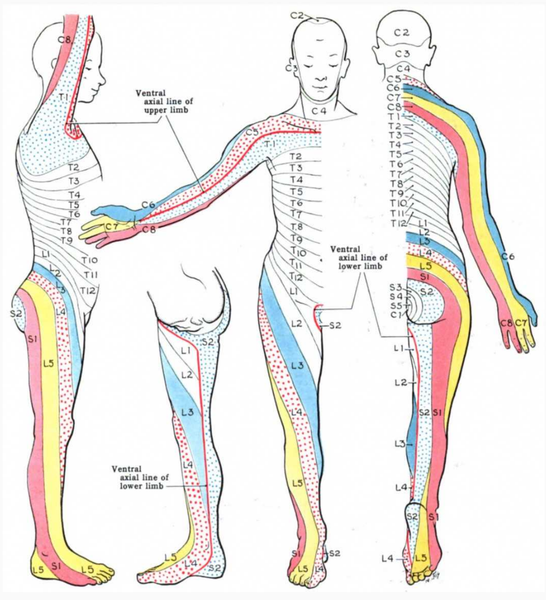
Answer

The S2 dermatome is best tested at the midpoint of the popliteal fossa.

Notes

Dermatome	Landmark
L1	Upper Anterior Thigh
L2	Mid Anterior Thigh
L3	Medial Femoral Condyle
L4	Medial Malleolus
L5	Dorsum 3rd MTP Joint
S1	Lateral Heel
S2	Popliteal Fossa
S3	Ischial Tuberosity
S5	Perianal Area

- The T12 dermatome is best tested at the midclavicular line, over the midpoint of the inguinal ligament.
- The L1 dermatome is best tested on the upper anterior thigh, at a point midway between the key sensory points for T12 and L2.
- The L2 dermatome is best tested on the anteromedial thigh, at the midpoint drawn on an imaginary line connecting the midpoint of the inguinal ligament and the medial femoral condyle.
- The L3 dermatome is best tested at the medial femoral condyle above the knee.
- The L4 dermatome is best tested over the medial malleolus.
- The L5 dermatome is best tested on the dorsum of the foot at the third metatarsophalangeal joint.
- The S1 dermatome is best tested on the lateral aspect of the calcaneus.
- The S2 dermatome is best tested at the midpoint of the popliteal fossa.
- The S3 dermatome is best tested over the ischial tuberosity or infragluteal fold (depending on the patient their skin can move up, down or laterally over the ischii).
- The S4/S5 dermatome is best tested in the perianal area, less than one cm lateral to the mucocutaneous junction.



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Anatomy: Leg and Foot



Question 26 of 110

The tibial nerve receives nerve fibres from which of the following nerve roots:

a L4 – S2

b L4 – S3

c S1 – S3

d S1 – S4

e L5 – S3

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The tibial nerve receives nerve fibres from which of the following nerve roots:

a) L4 – S2
b) L4 – S3 ✔
c) S1 – S3
d) S1 – S4
e) L5 – S3

Answer

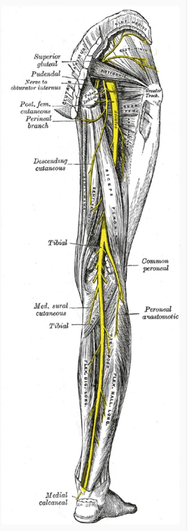
The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

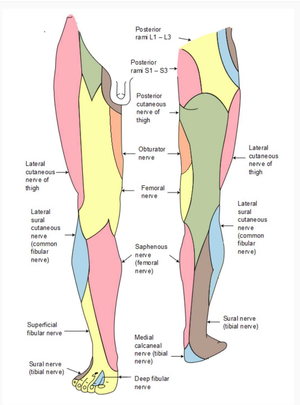


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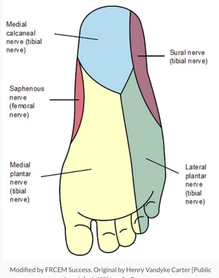
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 27 of 110

Which of the following muscle tendons enters the joint capsule of the knee:

a Gracilis

b Tibialis posterior

c Sartorius

d Popliteus

e Semimembranosus

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Anatomy: Leg and Foot

Question 27 of 110

Which of the following muscle tendons enters the joint capsule of the knee:

a) Gracilis
b) Tibialis posterior
c) Sartorius
d) **Popliteus** ✔
e) Semimembranosus

Answer

The upper end of the popliteus muscle tendon passes through an opening in the posterolateral aspect of the fibrous joint capsule of the knee. The popliteus tendon is intracapsular but extra-articular and extrasynovial.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

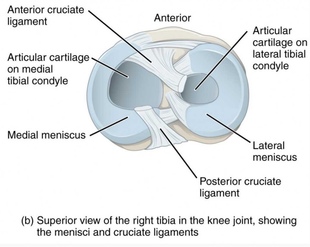
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyle that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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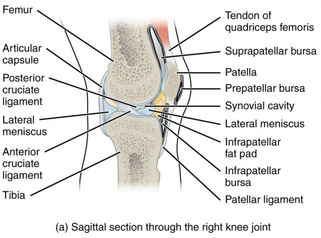
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 28 of 110

A 21 year old horse rider sustains a kick to the left leg from one of her horses. She has a large bruise over the head of the fibula. Which of the following nerves is most likely to be damaged in this type of injury:

a Deep fibular nerve

b Superficial fibular nerve

c Common fibular nerve

d Tibial nerve

e Saphenous nerve

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Anatomy: Leg and Foot

Question 28 of 110

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a) Deep fibular nerve
b) Superficial fibular nerve
c) **Common fibular nerve** ✔
d) Tibial nerve
e) Saphenous nerve

Answer

The common fibular nerve is vunerable to damage in this location where it wraps around the neck of the fibula.

Notes

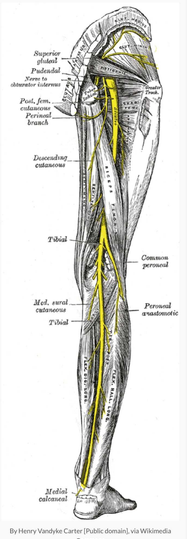
The common fibular nerve is a branch of the sciatic nerve receiving fibres from L4 – S2.

Nerve	Common fibular nerve
Nerve roots	L4 – S2
Motor supply	Short head of the biceps femoris, all muscles in the anterior and lateral compartments of the leg, all intrinsic dorsal foot muscles
Sensory supply	Skin over the lateral aspect of leg and ankle, and dorsal aspect of the foot and toes (except for the lateral side of little toe)
Motor loss in injury	Loss of dorsiflexion of ankle and foot eversion, weakness of foot inversion, loss of toe extension, foot drop with high-stepping gait and loss of sensation in above distribution

Anatomical course

The nerve arises at the apex of the popliteal fossa and follows the medial margin of the biceps femoris tendon over the lateral head of the gastrocnemius muscle. Here it gives rise to two cutaneous branches, the sural communicating nerve which joins the sural nerve (branch of the tibial nerve), and the lateral sural cutaneous nerve (supplying skin over the upper lateral leg).

The common fibular nerve continues by wrapping around the neck of the fibula and passing between the attachments of the fibularis longus muscle to enter the lateral compartment of the leg where it divides into its terminal branches, the superficial and deep fibular nerves.



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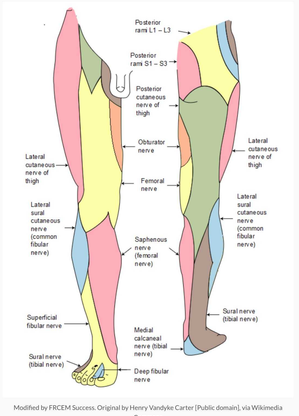
The common fibular nerve directly innervates the short head of the biceps femoris muscle and supplies skin over the upper lateral leg via its lateral sural cutaneous branch. Through its terminal branches, the common fibular nerve innervates all of the muscles in the anterior and lateral compartments of the leg and the dorsal intrinsic foot muscles and skin over the anterolateral aspect of the lower leg and the dorsal aspect of the foot and toes (except for the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Branch	Innervation
Muscular branch	Short head of biceps femoris muscle
Sural communicating nerve	Joins sural nerve
Lateral sural cutaneous nerve	Skin over upper lateral leg
Superficial fibular nerve	Lateral compartment of leg and skin over lower anterolateral leg, and dorsum of foot (except lateral side of little toe and skin over webspace of 1st and 2nd toe)
Deep fibular nerve	Anterior compartment of leg and skin over webspace between 1st and 2nd toes

Motor supply

Muscle	Action(s)	Innervation
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch	Superficial fibular nerve (L5 – S2)
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)

Sensory supply



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Anatomy: Leg and Foot



Question 29 of 110

A patient presents to the ED complaining of 3 days of lower back pain associated with pain radiating down their left leg. You perform a neurological examination and note paraesthesia in the L5 and S1 dermatomes. The L5 dermatome is best tested at which of the following landmarks:

a Lateral malleolus

b Medial malleolus

c Lateral heel

d Dorsum of the foot at the third metatarsophalangeal joint

e At the midpoint of the popliteal fossa

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Anatomy: Leg and Foot

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a) Lateral malleolus
b) Medial malleolus
c) Lateral heel
d) **Dorsum of the foot at the third metatarsophalangeal joint** ✔
e) At the midpoint of the popliteal fossa

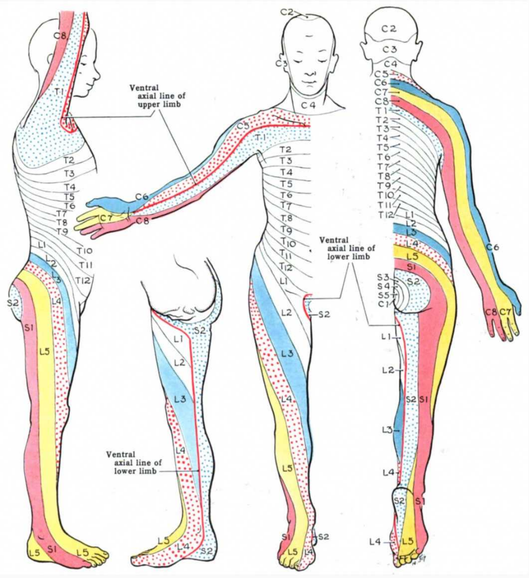
Answer

The L5 dermatome is best tested on the dorsum of the foot at the third metatarsophalangeal joint.

Notes

Dermatome	Landmark
L1	Upper Anterior Thigh
L2	Mid Anterior Thigh
L3	Medial Femoral Condyle
L4	Medial Malleolus
L5	Dorsum 3rd MTP Joint
S1	Lateral Heel
S2	Popliteal Fossa
S3	Ischial Tuberosity
S5	Perianal Area

- The T12 dermatome is best tested at the midclavicular line, over the midpoint of the inguinal ligament.
- The L1 dermatome is best tested on the upper anterior thigh, at a point midway between the key sensory points for T12 and L2.
- The L2 dermatome is best tested on the anteromedial thigh, at the midpoint drawn on an imaginary line connecting the midpoint of the inguinal ligament and the medial femoral condyle.
- The L3 dermatome is best tested at the medial femoral condyle above the knee.
- The L4 dermatome is best tested over the medial malleolus.
- The L5 dermatome is best tested on the dorsum of the foot at the third metatarsophalangeal joint.
- The S1 dermatome is best tested on the lateral aspect of the calcaneus.
- The S2 dermatome is best tested at the midpoint of the popliteal fossa.
- The S3 dermatome is best tested over the ischial tuberosity or infragluteal fold (depending on the patient their skin can move up, down or laterally over the ischii).
- The S4/S5 dermatome is best tested in the perianal area, less than one cm lateral to the mucocutaneous junction.



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Anatomy: Leg and Foot



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Which of the following muscles is NOT innervated by the tibial nerve:

a Popliteus

b Plantaris

c Tibialis anterior

d Tibialis posterior

e Soleus

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Which of the following muscles is NOT innervated by the tibial nerve:

a) Popliteus
b) Plantaris
c) **Tibialis anterior** ✔
d) Tibialis posterior
e) Soleus

Answer

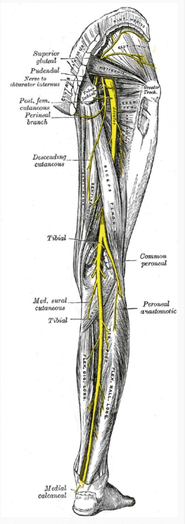
The tibial nerve innervates all of the muscles in the posterior compartment of the thigh, the posterior compartment of the leg and the intrinsic muscles in the sole of the foot. The tibialis anterior is found in the anterior leg, and is innervated by the deep fibular nerve.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

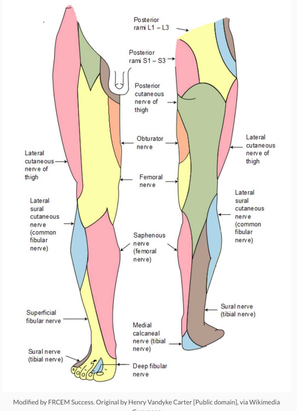


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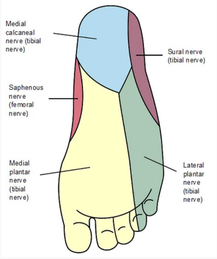
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 31 of 110

The cuboid bone articulates with all of the following tarsal bones except for the:

a Talus

b Calcaneus

c Navicular

d Lateral cuneiform

e Lateral two metatarsals

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a) Talus ✔
b) **Calcaneus** ✘
c) Navicular
d) Lateral cuneiform
e) Lateral two metatarsals

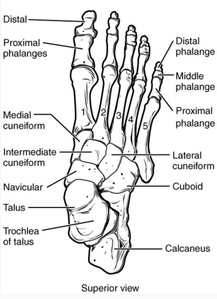
Answer

The cuboid articulates with the calcaneus and the navicular posteriorly, the lateral cuneiform medially and the bases of the lateral two metatarsals anteriorly.

Notes

Tarsal bones

There are three groups of bones in the foot; the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

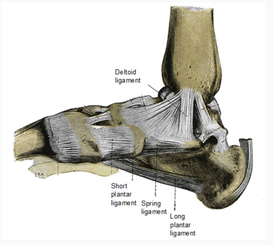
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

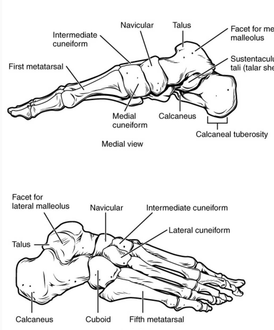
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 32 of 110

A 64 year old man undergoes coronary artery bypass graft surgery (CABG) using the great saphenous vein. Following the procedure he complains of abnormal sensation over the medial leg and foot. Which of the following nerves has most likely been affected:

a Sural nerve

b Common fibular nerve

c Superficial fibular nerve

d Saphenous nerve

e Tibial nerve

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Question 32 of 110

A 64 year old man undergoes coronary artery bypass graft surgery (CABG) using the great saphenous vein. Following the procedure he complains of abnormal sensation over the medial leg and foot. Which of the following nerves has most likely been affected:

a) Sural nerve
b) Common fibular nerve
c) Superficial fibular nerve
d) **Saphenous nerve** ✔
e) Tibial nerve

Answer

The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.

Notes

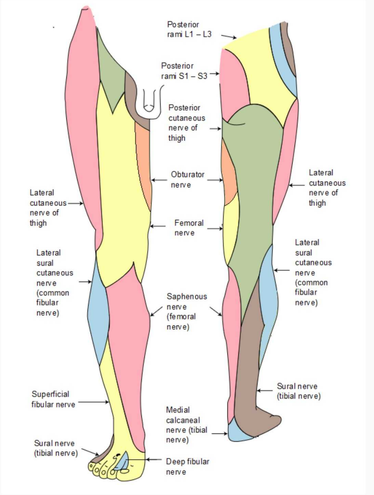
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

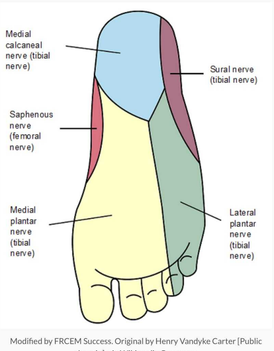
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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Anatomy: Leg and Foot



Question 33 of 110

Which of the following structures primarily supports the lateral longitudinal arch rather than the medial longitudinal arch of the foot:

a Deltoid ligament

b Spring ligament

c Tibialis anterior tendon

d Tibialis posterior tendon

e Fibularis longus tendon

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Question 33 of 110

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c) Tibialis anterior tendon
d) Tibialis posterior tendon
e) **Fibularis longus tendon** ✔

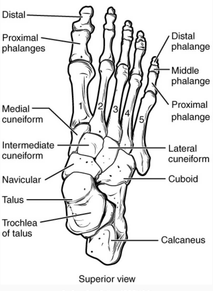
Answer

The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

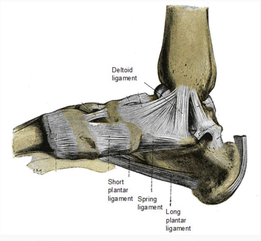
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

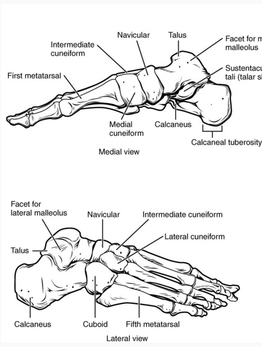
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 34 of 110

The fibularis longus muscle acts to produce which of the following movements:

a Plantarflexion and inversion of the foot

b Plantarflexion and eversion of the foot

c Dorsiflexion and eversion of the foot

d Dorsiflexion and inversion of the foot

e Plantarflexion alone

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Anatomy: Leg and Foot

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The fibularis longus muscle acts to produce which of the following movements:

a) Plantarflexion and inversion of the foot
b) **Plantarflexion and eversion of the foot** ✔
c) Dorsiflexion and eversion of the foot
d) Dorsiflexion and inversion of the foot
e) Plantarflexion alone

Answer

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

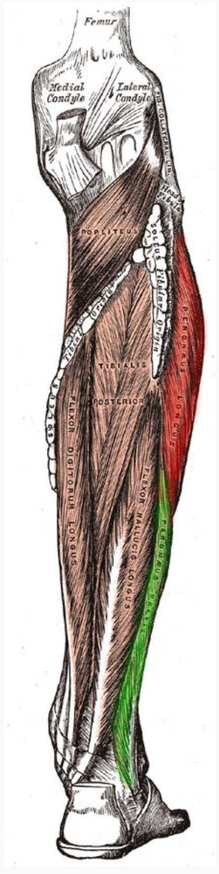
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 35 of 110

A 19 year old professional athlete presents to ED having injured his right foot during training. There is bruising and swelling over the medial malleolus and the patient shows excessive eversion of his foot. Which of the following ligaments is most likely affected:

a Spring ligament

b Anterior talofibular ligament

c Calcaneofibular ligament

d Deltoid ligament

e Long plantar ligament

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Question 35 of 110

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a) **Spring ligament** ✖
b) Anterior talofibular ligament
c) Calcaneofibular ligament
d) Deltoid ligament ✔
e) Long plantar ligament

Answer

The deltoid (medial collateral) ligament acts to prevent over eversion of the foot and helps maintain the medial longitudinal arch. The anterior talofibular and calcaneofibular ligament form part of the lateral collateral ligament which acts to resist inversion of the foot. The spring ligament and long plantar ligament are involved in maintaining the arches of the foot.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

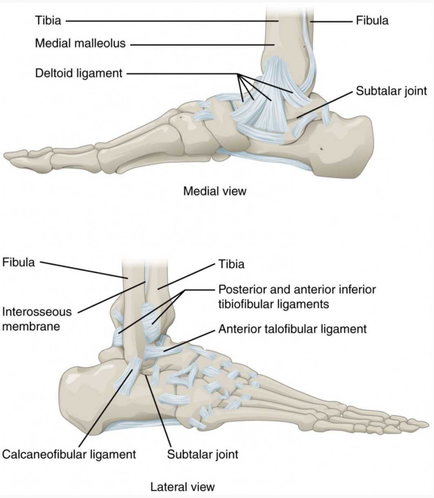
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 36 of 110

During rehabilitation after a significant road traffic accident, it is noted that a patient has a problem unlocking the extended knee joint to permit flexion of the leg. Which of the following muscles has most likely been injured:

a Rectus femoris

b Sartorius

c Gracilis

d Gastrocnemius

e Popliteus

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Question 36 of 110

During rehabilitation after a significant road traffic accident, it is noted that a patient has a problem unlocking the extended knee joint to permit flexion of the leg. Which of the following muscles has most likely been injured:

a) Rectus femoris
b) Sartorius
c) Gracilis
d) Gastrocnemius
e) **Popliteus** ✔

Answer

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint.

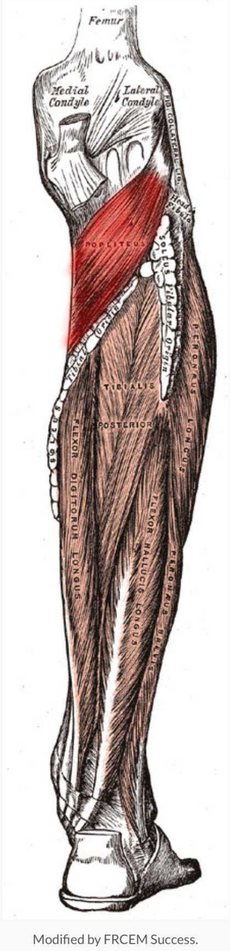
Notes

The popliteus muscle is the smallest and most superior of the deep muscles in the posterior compartment of the leg.

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint. It stabilises the knee by resisting lateral rotation of the tibia on the femur.

The popliteus muscle is also attached to the lateral meniscus in the knee and draws it posteriorly during knee flexion thus preventing its entrapment.

The popliteus is innervated by the tibial nerve (L4 – S1).



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Anatomy: Leg and Foot



Question 37 of 110

Which of the following nerves is most important for plantarflexion of the foot at the ankle joint:

a Tibial nerve

b Common fibular nerve

c Superficial fibular nerve

d Deep fibular nerve

e Saphenous nerve

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Anatomy: Leg and Foot

Question 37 of 110

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a) **Tibial nerve** ✔
b) Common fibular nerve
c) Superficial fibular nerve
d) Deep fibular nerve
e) Saphenous nerve

Answer

Plantarflexion of the foot at the ankle joint is primarily performed by muscles of the posterior compartment of the leg, innervated by the tibial nerve. The fibularis longus, innervated by the deep fibular nerve assists in this action.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

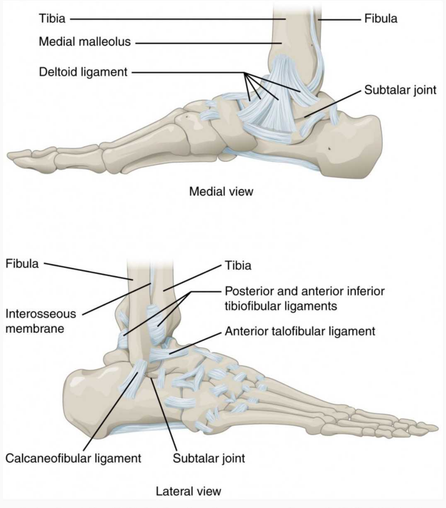
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 38 of 110

The muscles of the posterior compartment of the leg collectively act together to primarily produce which of the following movements:

a Eversion of the foot

b Inversion of the foot

c Dorsiflexion of the foot

d Plantarflexion of the foot

e Flexion of the leg

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The muscles of the posterior compartment of the leg collectively act together to primarily produce which of the following movements:

a) Eversion of the foot
b) Inversion of the foot
c) Dorsiflexion of the foot
d) **Plantarflexion of the foot** ✔
e) Flexion of the leg

Answer

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve and act collectively to produce plantarflexion of the foot.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

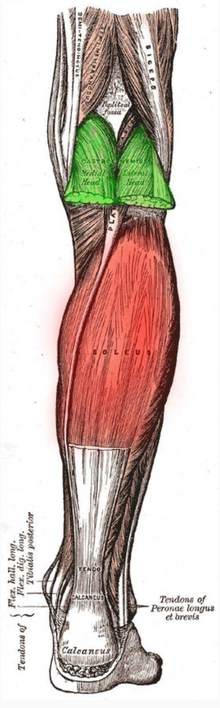
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

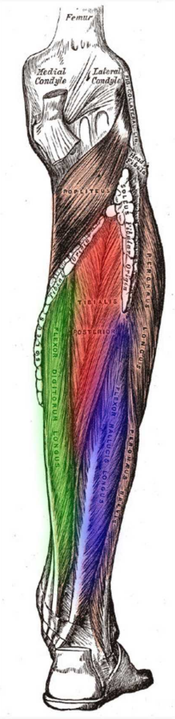
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 39 of 110

A 25 year old female presents with a swollen right ankle after twisting her ankle whilst wearing high heels on a night out. There is pain and swelling over the lateral aspect of the ankle but x-ray does not show any fractures. Which of the following ligaments has most likely been injured:

a Deltoid ligament

b Long plantar ligament

c Short plantar ligament

d Spring ligament

e Calcaneofibular ligament

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a) Deltoid ligament
b) Long plantar ligament
c) Short plantar ligament
d) Spring ligament
e) **Calcaneofibular ligament** ✔

Answer

Inversion injuries at the ankle in plantarflexion (such as when wearing high heels) are common, and typically result in damage to the lateral collateral ligament of the ankle, made up of the anterior talofibular, the calcaneofibular and the posterior talofibular ligaments. The anterior talofibular and the calcaneofibular ligaments are most commonly injured, and the posterior talofibular ligament rarely. The spring ligament supports the head of the talus, the deltoid ligament supports the medial aspect of the ankle joint, and the long and short plantar ligaments are involved in maintaining the lateral longitudinal arch of the foot.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

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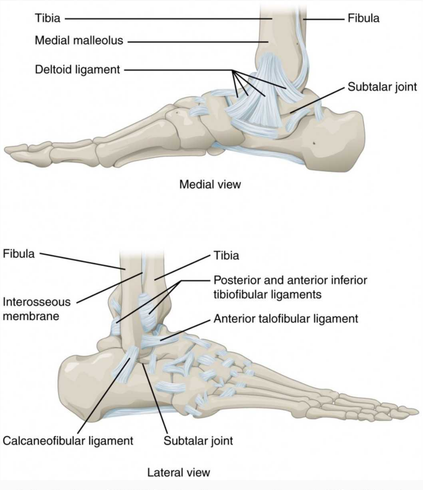
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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 40 of 110

A 32 year old scaffolder is brought to the ED after falling from a building. He is complaining of pain in his lower back. On examination you note loss of sensation in the S1 and S2 dermatome. The S1 dermatome is best tested at which of the following landmarks:

a Medial malleolus

b Lateral malleolus

c Over the inferior heel

d Over the lateral heel

e At the dorsum of the foot at the third metatarsophalangeal joint

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b) Lateral malleolus
c) Over the inferior heel
d) **Over the lateral heel** ✔
e) At the dorsum of the foot at the third metatarsophalangeal joint

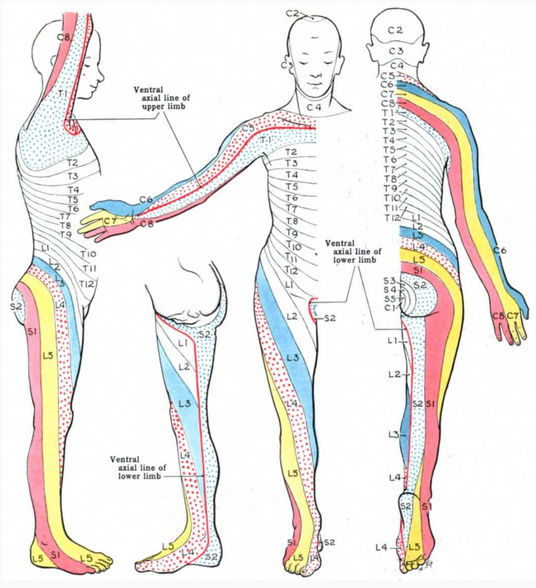
Answer

The S1 dermatome is best tested on the lateral aspect of the calcaneus.

Notes

Dermatome	Landmark
L1	Upper Anterior Thigh
L2	Mid Anterior Thigh
L3	Medial Femoral Condyle
L4	Medial Malleolus
L5	Dorsum 3rd MTP Joint
S1	Lateral Heel
S2	Popliteal Fossa
S3	Ischial Tuberosity
S5	Perianal Area

- The T12 dermatome is best tested at the midclavicular line, over the midpoint of the inguinal ligament.
- The L1 dermatome is best tested on the upper anterior thigh, at a point midway between the key sensory points for T12 and L2.
- The L2 dermatome is best tested on the anteromedial thigh, at the midpoint drawn on an imaginary line connecting the midpoint of the inguinal ligament and the medial femoral condyle.
- The L3 dermatome is best tested at the medial femoral condyle above the knee.
- The L4 dermatome is best tested over the medial malleolus.
- The L5 dermatome is best tested on the dorsum of the foot at the third metatarsophalangeal joint.
- The S1 dermatome is best tested on the lateral aspect of the calcaneus.
- The S2 dermatome is best tested at the midpoint of the popliteal fossa.
- The S3 dermatome is best tested over the ischial tuberosity or infragluteal fold (depending on the patient their skin can move up, down or laterally over the ischii).
- The S4/S5 dermatome is best tested in the perianal area, less than one cm lateral to the mucocutaneous junction.



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Anatomy: Leg and Foot



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Inversion of the foot is primarily produced by which of the following muscles:

a Tibialis anterior and extensor hallucis longus

b Tibialis anterior and tibialis posterior

c Fibularis longus and fibularis brevis

d Tibialis anterior and fibularis longus

e Tibialis posterior and fibularis longus

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a) Tibialis anterior and extensor hallucis longus
b) **Tibialis anterior and tibialis posterior** ✔
c) Fibularis longus and fibularis brevis
d) Tibialis anterior and fibularis longus
e) Tibialis posterior and fibularis longus

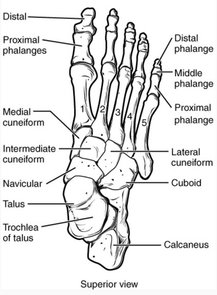
Answer

The subtalar and transverse tarsal joints allow inversion and eversion of the foot. Inversion of the foot is primarily produced by the tibialis anterior and tibialis posterior muscles. Eversion of the foot is primarily produced by the fibularis longus, fibularis brevis and fibularis tertius muscles.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

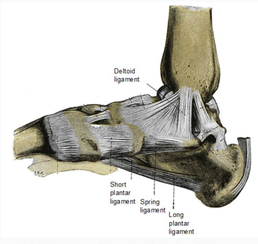
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

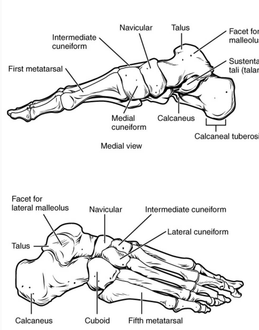
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



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The common fibular nerve receives nerve fibres from which of the following nerve roots:

a L4 – S2

b L4 – S3

c S1 – S3

d S1 – S4

e L5 – S3

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The common fibular nerve receives nerve fibres from which of the following nerve roots:

a) L4 – S2 ✔
b) L4 – S3 ✘
c) S1 – S3
d) S1 – S4
e) L5 – S3

Answer

The common fibular nerve is a branch of the sciatic nerve receiving fibres from L4 – S2.

Notes

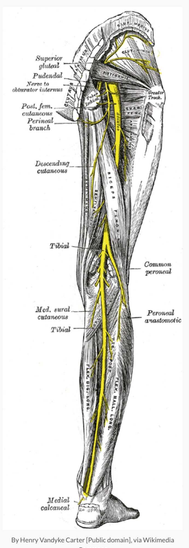
The common fibular nerve is a branch of the sciatic nerve receiving fibres from L4 – S2.

Nerve	Common fibular nerve
Nerve roots	L4 – S2
Motor supply	Short head of the biceps femoris, all muscles in the anterior and lateral compartments of the leg, all intrinsic dorsal foot muscles
Sensory supply	Skin over the lateral aspect of leg and ankle, and dorsal aspect of the foot and toes (except for the lateral side of little toe)
Motor loss in injury	Loss of dorsiflexion of ankle and foot eversion, weakness of foot inversion, loss of toe extension, foot drop with high-stepping gait and loss of sensation in above distribution

Anatomical course

The nerve arises at the apex of the popliteal fossa and follows the medial margin of the biceps femoris tendon over the lateral head of the gastrocnemius muscle. Here it gives rise to two cutaneous branches, the sural communicating nerve which joins the sural nerve (branch of the tibial nerve), and the lateral sural cutaneous nerve (supplying skin over the upper lateral leg).

The common fibular nerve continues by wrapping around the neck of the fibula and passing between the attachments of the fibularis longus muscle to enter the lateral compartment of the leg where it divides into its terminal branches, the superficial and deep fibular nerves.



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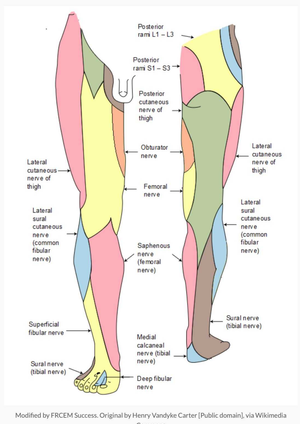
The common fibular nerve directly innervates the short head of the biceps femoris muscle and supplies skin over the upper lateral leg via its lateral sural cutaneous branch. Through its terminal branches, the common fibular nerve innervates all of the muscles in the anterior and lateral compartments of the leg and the dorsal intrinsic foot muscles and skin over the anterolateral aspect of the lower leg and the dorsal aspect of the foot and toes (except for the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Branch	Innervation
Muscular branch	Short head of biceps femoris muscle
Sural communicating nerve	Joins sural nerve
Lateral sural cutaneous nerve	Skin over upper lateral leg
Superficial fibular nerve	Lateral compartment of leg and skin over lower anterolateral leg, and dorsum of foot (except lateral side of little toe and skin over webspace of 1st and 2nd toe)
Deep fibular nerve	Anterior compartment of leg and skin over webspace between 1st and 2nd toes

Motor supply

Muscle	Action(s)	Innervation
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch	Superficial fibular nerve (L5 – S2)
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)

Sensory supply



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Anatomy: Leg and Foot



Question 43 of 110

A 24 year old man sustains a laceration of his left leg that transects the superficial vein that enters the popliteal fossa to terminate in the popliteal vein. Which of the following blood vessels has most likely been affected:

a Great saphenous vein

b Small saphenous vein

c Anterior tibial vein

d Posterior tibial vein

e Fibular vein

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Question 43 of 110

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a) Great saphenous vein
b) **Small saphenous vein** ✔
c) Anterior tibial vein
d) Posterior tibial vein
e) Fibular vein

Answer

The small saphenous vein ascends in the superficial fascia on the back of the leg to the knee where it penetrates the deep fascia and enters the popliteal fossa to drain into the popliteal vein.

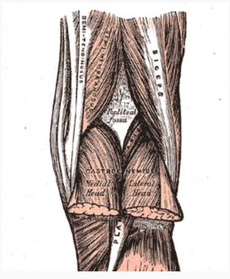
Notes

The popliteal fossa is a diamond-shaped space behind the knee joint.

Popliteal fossa	Structure(s)
Superomedial border	Semimembranosus
Superolateral border	Biceps femoris
Inferomedial border	Medial head of gastrocnemius
Inferolateral border	Lateral head of gastrocnemius and plantaris
Floor	Knee joint capsule and adjacent surfaces of femur and tibia and popliteus muscle
Roof	Deep fascia
Contents	Popliteal artery, popliteal vein, tibial nerve, common fibular nerve

The popliteal fossa is bordered:

- superomedially by the semimembranosus
- superolaterally by the biceps femoris
- inferomedially by the medial head of the gastrocnemius
- inferolaterally by the lateral head of the gastrocnemius and plantaris

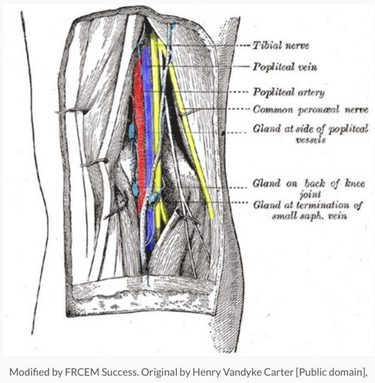


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The floor of the fossa is formed by the capsule of the knee joint and adjacent surfaces of the femur and tibia, and more inferiorly by the popliteus muscle. The roof is formed by deep fascia.

The major structures contained within the popliteal fossa are (from medial to lateral):

- the popliteal artery
- the popliteal vein
- the tibial nerve
- the common fibular nerve



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The small saphenous vein ascends in the superficial fascia on the back of the leg to the knee where it penetrates the deep fascia and enters the popliteal fossa to drain into the popliteal vein. One other structure that passes through the roof of the fossa is the posterior cutaneous nerve of the thigh which descends through the thigh superficial to the hamstring muscles, passes through the roof of the popliteal fossa, and then continues inferiorly with the small saphenous vein to supply skin on the upper half of the posterior leg.

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Question 44 of 110

The skin over the medial leg is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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The skin over the medial leg is primarily supplied by which of the following nerves:

a) Sural nerve
b) Common fibular nerve
c) Tibial nerve
d) **Saphenous nerve** ✔
e) Superficial fibular nerve

Answer

The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.

Notes

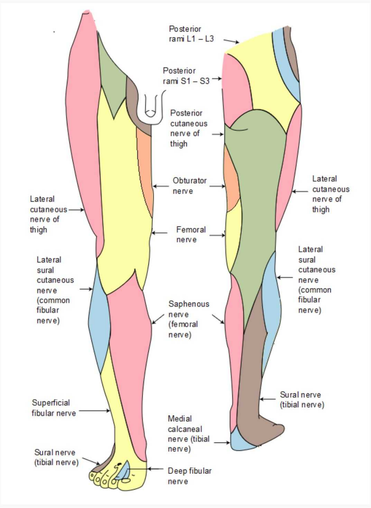
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

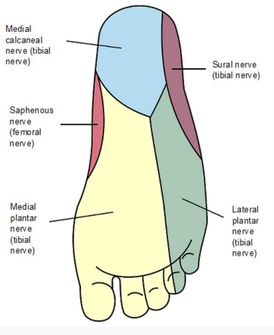
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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The fibularis brevis muscle attaches distally to which of the following structures:

a Cuboid

b Lateral cuneiform

c Intermediate cuneiform

d Base of 5th metatarsal

e Base of 4th metatarsal

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The fibularis brevis muscle attaches distally to which of the following structures:

a) Cuboid
b) Lateral cuneiform
c) Intermediate cuneiform
d) **Base of 5th metatarsal** ✔
e) Base of 4th metatarsal

Answer

The fibularis brevis curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal.

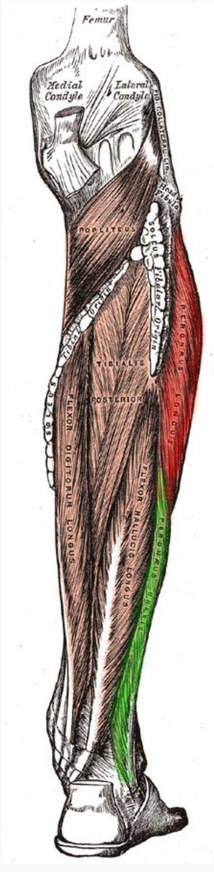
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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The long flexor tendons of the flexor digitorum longus and flexor hallucis longus muscles lie within which of the muscular layers of the sole of the foot:

a Within the first layer

b Within the second layer

c Within the third layer

d Within the fourth layer

e Between the third and fourth layer

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Question 46 of 110

The long flexor tendons of the flexor digitorum longus and flexor hallucis longus muscles lie within which of the muscular layers of the sole of the foot:

a) Within the first layer
b) **Within the second layer** ✔
c) Within the third layer
d) Within the fourth layer
e) Between the third and fourth layer

Answer

The long flexor tendons of the flexor hallucis longus and flexor digitorum longus muscles lie within the second layer.

Notes

The muscles in the sole of the foot are organised into four layers. Detailed knowledge of the muscles which lie within a given layer is not required, but the following is required knowledge and has implications for the structures likely to compromised when the sole is injured.

The plantar arteries and nerves lie between the first and second layers.

The long flexor tendons of the flexor hallucis longus and flexor digitorum longus muscles lie within the second layer.

The tendons of the tibialis posterior and fibularis longus muscles are part of the fourth layer.

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Question 47 of 110

Regarding the cruciate ligaments, which of the following statements is CORRECT:

a The anterior cruciate ligament is the stronger of the two cruciate ligaments.

b The anterior cruciate ligament prevents posterior dislocation of the tibia relative to the femur.

c The posterior cruciate ligament attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly.

d The posterior cruciate ligament is typically injured in a hyperflexion injury.

e The 'unhappy triad' refers to injury to the posterior cruciate ligament, tibial collateral ligament and medial meniscus.

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Question 47 of 110

Regarding the cruciate ligaments, which of the following statements is CORRECT:

a) The anterior cruciate ligament is the stronger of the two cruciate ligaments.
b) The anterior cruciate ligament prevents posterior dislocation of the tibia relative to the femur.
c)
The posterior cruciate ligament attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly.
d) **The posterior cruciate ligament is typically injured in a hyperflexion injury.** ✔
e)
The 'unhappy triad' refers to injury to the posterior cruciate ligament, tibial collateral ligament and medial meniscus.

Answer

The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The 'unhappy triad' refers to injury to the anterior cruciate ligament, the tibial collateral ligament and the medial meniscus.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

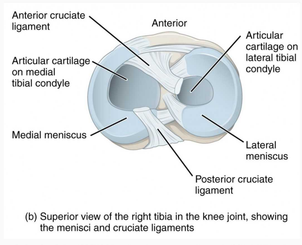
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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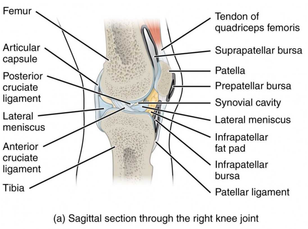
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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The skin over the sole of the foot is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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The skin over the sole of the foot is primarily supplied by which of the following nerves:

a) Sural nerve
b) Common fibular nerve
c) **Tibial nerve** ✔
d) Saphenous nerve
e) Superficial fibular nerve

Answer

The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel. The sole of the heel is supplied by the medial calcaneal branch of the tibial nerve.

Notes

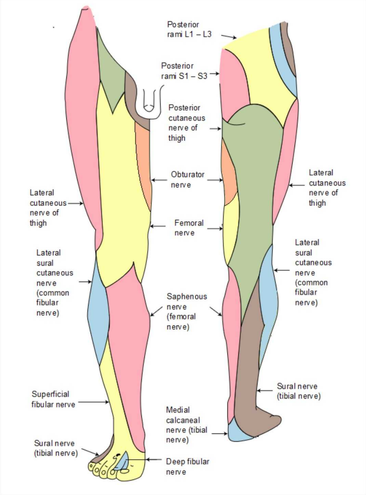
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

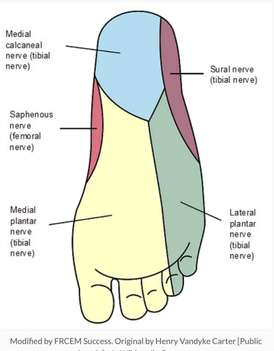
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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The oblique popliteal tendon is an extension of which of the following muscles:

a Semitendinosus

b Biceps femoris

c Semimembranosus

d Sartorius

e Gracilis

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a) Semitendinosus
b) Biceps femoris
c) Semimembranosus ✔
d) **Sartorius** ✘
e) Gracilis

Answer

The oblique popliteal ligament is an extension of the semimembranosus tendon and reinforces the joint capsule posteromedially.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

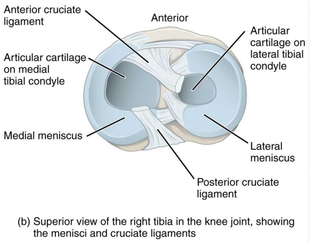
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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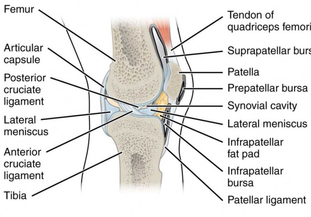
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 50 of 110

The skin over the lower anterolateral leg is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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Anatomy: Leg and Foot

Question 50 of 110

The skin over the lower anterolateral leg is primarily supplied by which of the following nerves:

a) Sural nerve
b) Common fibular nerve
c) Tibial nerve
d) Saphenous nerve
e) **Superficial fibular nerve** ✔

Answer

The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).

Notes

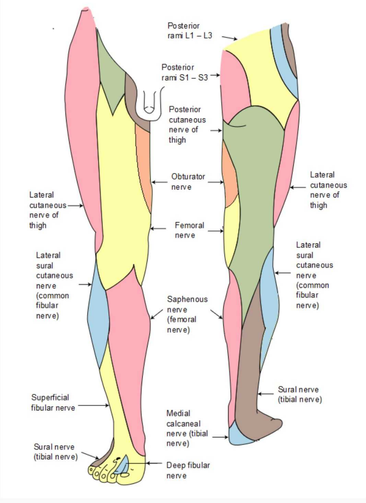
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

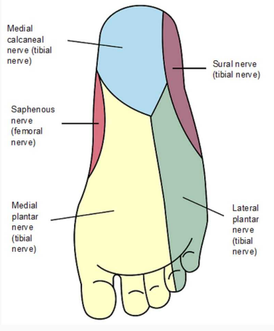
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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Anatomy: Leg and Foot



Question 51 of 110

Regarding the collateral ligaments of the ankle joint, which of the following statements is CORRECT:

a The lateral collateral ligament is the stronger of the two.

b The collateral ligaments mainly prevent over extension of the ankle joint.

c The lateral collateral ligament attaches distally to the navicular bone.

d The medial collateral ligament attaches distally to the talus, calcaneus and the navicular bone.

e The lateral collateral ligament is continuous distally with the spring ligament.

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Anatomy: Leg and Foot

Question 51 of 110

Regarding the collateral ligaments of the ankle joint, which of the following statements is CORRECT:

a) The lateral collateral ligament is the stronger of the two.
b) The collateral ligaments mainly prevent over extension of the ankle joint.
c) The lateral collateral ligament attaches distally to the navicular bone.
d) ✔
The medial collateral ligament attaches distally to the talus, calcaneus and the navicular bone.
e) The lateral collateral ligament is continuous distally with the spring ligament.

Answer

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch. The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

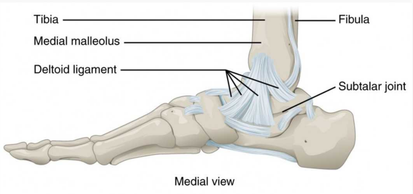
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

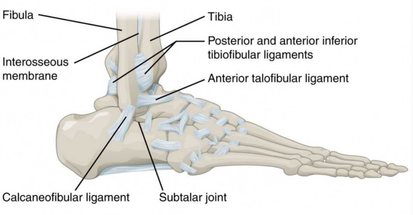
The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



Medial view



Lateral view

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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 52 of 110

Which of the following would you NOT expect from a deep fibular nerve palsy:

a Loss of dorsiflexion

b Loss of extension of the toes

c Foot drop

d Loss of sensation over heel

e High-steppage gait

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Anatomy: Leg and Foot

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Which of the following would you NOT expect from a deep fibular nerve palsy:

a) Loss of dorsiflexion
b) Loss of extension of the toes
c) Foot drop
d) **Loss of sensation over heel** ✔
e) High-steppage gait

Answer

Damage to the deep fibular nerve results in loss of dorsiflexion of the ankle, with resultant foot drop with high-stepping gait, loss of toe extension, weakness of foot inversion and loss of sensation over the webspace between the 1st and 2nd toes.

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

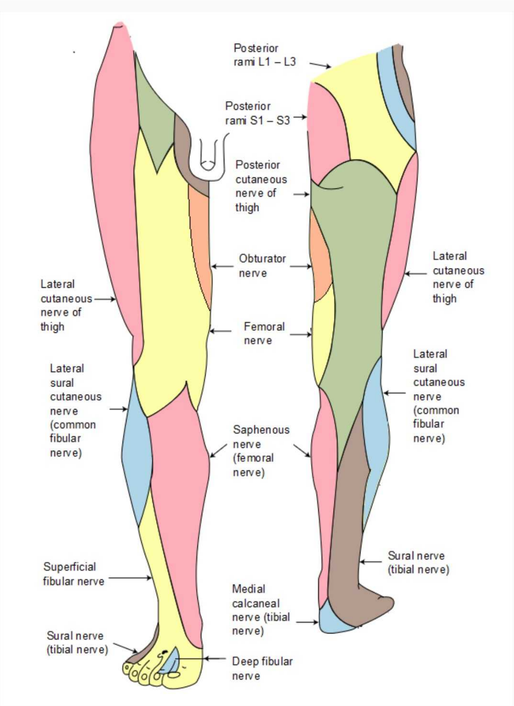
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



Question 53 of 110

A 21 year old man sustains an injury to his left leg during a judo match. He is complaining of loss of sensation over the sole of his foot and weakness of flexion of his toes. Which of the following nerves has most likely been damaged:

a Common fibular nerve

b Deep fibular nerve

c Superficial fibular nerve

d Sural nerve

e Tibial nerve

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A 21 year old man sustains an injury to his left leg during a judo match. He is complaining of loss of sensation over the sole of his foot and weakness of flexion of his toes. Which of the following nerves has most likely been damaged:

a) Common fibular nerve
b) Deep fibular nerve
c) Superficial fibular nerve
d) Sural nerve
e) Tibial nerve ✔

Answer

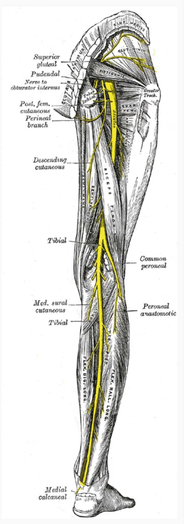
The medial and lateral plantar nerves, branches of the tibial nerve, innervate the intrinsic foot muscles in the sole of the foot, and supply skin over the sole of the foot.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

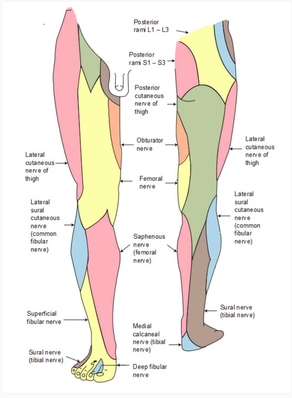


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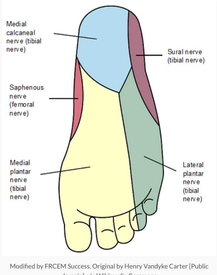
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 54 of 110

The deep fibular nerve supplies which of the following areas of skin:

a Lateral foot

b Medial foot

c Webspace between 1st and 2nd toe

d Heel

e Sole of foot

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The deep fibular nerve supplies which of the following areas of skin:

a) Lateral foot
b) Medial foot
c) **Webspace between 1st and 2nd toe** ✔
d) Heel
e) Sole of foot

Answer

The deep fibular nerve supplies skin over the webspace between the 1st and 2nd toe.

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

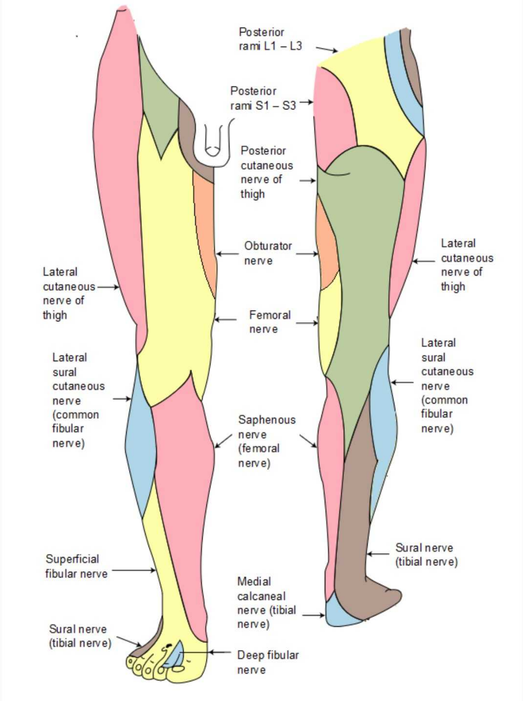
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



Question 55 of 110

A 23 year old dancer presents to ED after falling and injuring her left foot. X-ray demonstrates a fracture involving the ankle joint. Which of the following movements are most likely affected by this injury:

a Inversion and eversion

b Dorsiflexion and plantarflexion

c Dorsiflexion, plantarflexion, eversion and inversion

d Plantarflexion and inversion

e Dorsiflexion and eversion

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Anatomy: Leg and Foot

Question 55 of 110

A 23 year old dancer presents to ED after falling and injuring her left foot. X-ray demonstrates a fracture involving the ankle joint. Which of the following movements are most likely affected by this injury:

a) Inversion and eversion
b) **Dorsiflexion and plantarflexion** ✔
c) Dorsiflexion, plantarflexion, eversion and inversion
d) Plantarflexion and inversion
e) Dorsiflexion and eversion

Answer

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus, permitted dorsiflexion and plantarflexion of the foot. Inversion and eversion movements occur at the intertarsal joints, primarily at the subtalar and transverse tarsal joints.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

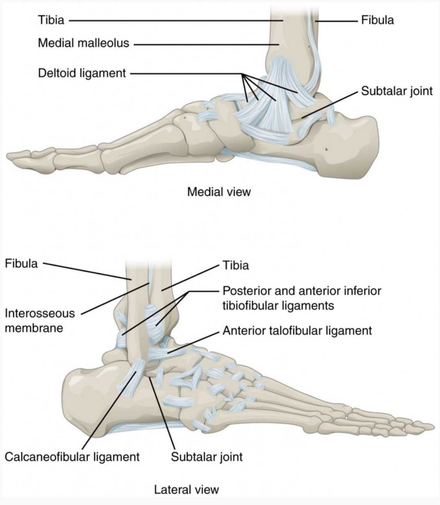
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 56 of 110

Which of the following best describes the cutaneous innervation of the tibial nerve and its branches:

a Posteromedial leg, medial foot and sole of foot

b Posterolateral leg, lateral foot, sole and heel of foot

c Posterolateral leg, lateral foot and dorsum of lateral two toes

d Dorsum and heel of foot

e Posterior leg and sole of foot

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Anatomy: Leg and Foot

Question 56 of 110

Which of the following best describes the cutaneous innervation of the tibial nerve and its branches:

a) **Posteromedial leg, medial foot and sole of foot** ✗
b) Posterolateral leg, lateral foot, sole and heel of foot ✓
c) Posterolateral leg, lateral foot and dorsum of lateral two toes
d) Dorsum and heel of foot
e) Posterior leg and sole of foot

Answer

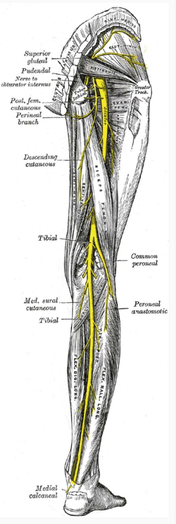
The tibial nerve supplies skin over the posterolateral lower leg and ankle, the lateral foot and little toe, the medial heel and the sole of the foot.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

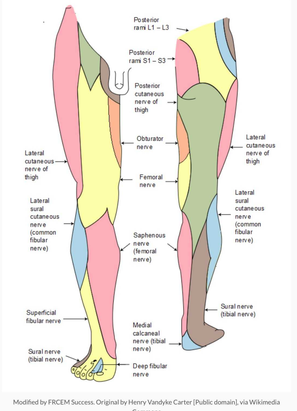


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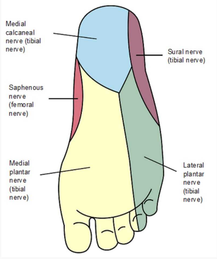
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 57 of 110

Which of the following synovial joint types best describes the ankle joint:

a Synovial hinge joint

b Synovial pivot joint

c Synovial saddle joint

d Synovial ball and socket joint

e Synovial condyloid joint

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Which of the following synovial joint types best describes the ankle joint:

a) Synovial hinge joint ✔
b) Synovial pivot joint
c) Synovial saddle joint
d) Synovial ball and socket joint
e) Synovial condyloid joint

Answer

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

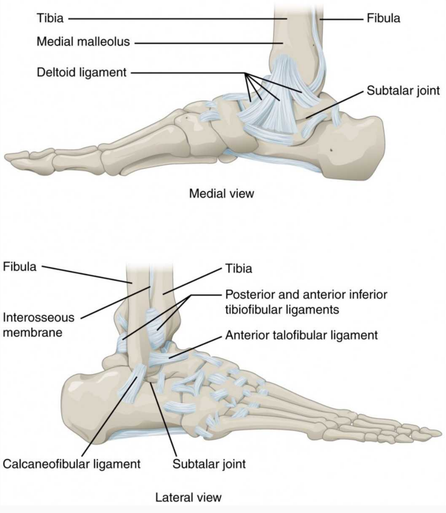
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 58 of 110

The tibialis anterior muscle is innervated by which of the following nerves:

a Common fibular nerve

b Deep fibular nerve

c Superficial fibular nerve

d Sciatic nerve

e Tibial nerve

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Anatomy: Leg and Foot

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The tibialis anterior muscle is innervated by which of the following nerves:

a) Common fibular nerve
b) **Deep fibular nerve** ✔
c) Superficial fibular nerve
d) Sciatic nerve
e) Tibial nerve

Answer

The tibialis anterior (red) is innervated by the deep fibular nerve (L4, L5).

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

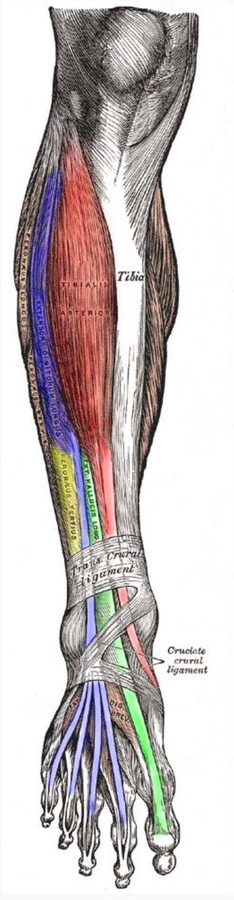
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

The extensor hallucis longus (green) extends the great toe and dorsiflexes the foot at the ankle joint.

The extensor digitorum longus (blue) extends the lateral four toes and dorsiflexes the foot at the ankle.

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



Question 59 of 110

The talus bone articulates with which of the following tarsal bones:

- a Calcaneus and cuboid
- b Navicular
- c Calcaneus
- d Navicular and calcaneus
- e Navicular and cuboid
- Navicular and intermediate cuneiform

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The talus bone articulates with which of the following tarsal bones:

a) Calcaneus and cuboid
b) Navicular
c) Calcaneus
d) **Navicular and calcaneus** ✔
e) Navicular and cuboid
Navicular and intermediate cuneiform

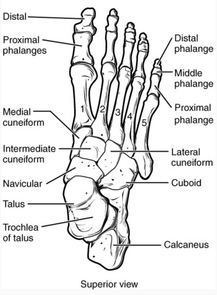
Answer

The talus bone articulates with the tibia and fibula superiorly, the calcaneus inferiorly and the navicular anteriorly

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

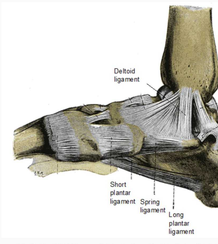
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

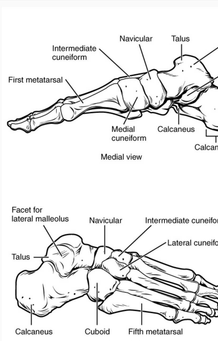
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 60 of 110

The muscles in the anterior compartment of the leg are all innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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Anatomy: Leg and Foot

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a) Common fibular nerve
b) Sciatic nerve
c) **Deep fibular nerve** ✔
d) Superficial fibular nerve
e) Tibial nerve

Answer

These anterior leg muscles are all innervated by the deep fibular nerve.

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

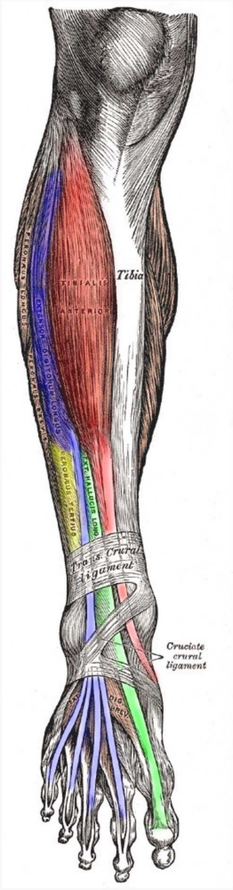
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

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The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



Question 61 of 110

The common fibular nerve directly supplies which of the following areas of skin:

a Upper lateral leg

b Lower lateral leg and dorsum of foot

c Lower posterolateral leg

d Anteromedial leg

e Posteromedial leg

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The common fibular nerve directly supplies which of the following areas of skin:

a) Upper lateral leg ✔
b) Lower lateral leg and dorsum of foot
c) Lower posterolateral leg
d) Anteromedial leg
e) Posteromedial leg

Answer

The lateral sural cutaneous branch of the common fibular nerve supplies skin over the upper lateral leg.

Notes

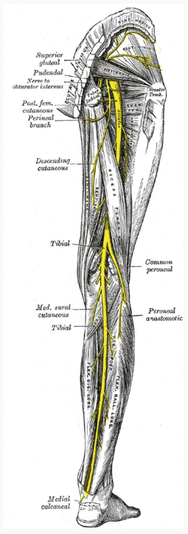
The common fibular nerve is a branch of the sciatic nerve receiving fibres from L4 – S2.

Nerve	Common fibular nerve
Nerve roots	L4 – S2
Motor supply	Short head of the biceps femoris, all muscles in the anterior and lateral compartments of the leg, all intrinsic dorsal foot muscles
Sensory supply	Skin over the lateral aspect of leg and ankle, and dorsal aspect of the foot and toes (except for the lateral side of little toe)
Motor loss in injury	Loss of dorsiflexion of ankle and foot eversion, weakness of foot inversion, loss of toe extension, foot drop with high-stepping gait and loss of sensation in above distribution

Anatomical course

The nerve arises at the apex of the popliteal fossa and follows the medial margin of the biceps femoris tendon over the lateral head of the gastrocnemius muscle. Here it gives rise to two cutaneous branches, the sural communicating nerve which joins the sural nerve (branch of the tibial nerve), and the lateral sural cutaneous nerve (supplying skin over the upper lateral leg).

The common fibular nerve continues by wrapping around the neck of the fibula and passing between the attachments of the fibularis longus muscle to enter the lateral compartment of the leg where it divides into its terminal branches, the superficial and deep fibular nerves.



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Function

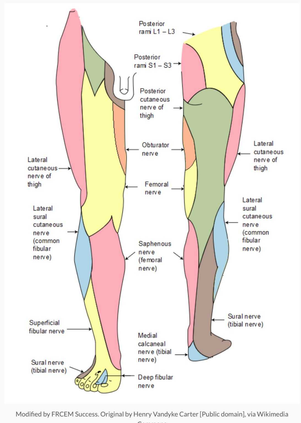
The common fibular nerve directly innervates the short head of the biceps femoris muscle and supplies skin over the upper lateral leg via its lateral sural cutaneous branch. Through its terminal branches, the common fibular nerve innervates all of the muscles in the anterior and lateral compartments of the leg and the dorsal intrinsic foot muscles and skin over the anterolateral aspect of the lower leg and the dorsal aspect of the foot and toes (except for the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Branch	Innervation
Muscular branch	Short head of biceps femoris muscle
Sural communicating nerve	Joins sural nerve
Lateral sural cutaneous nerve	Skin over upper lateral leg
Superficial fibular nerve	Lateral compartment of leg and skin over lower anterolateral leg, and dorsum of foot (except lateral side of little toe and skin over webspace of 1st and 2nd toe)
Deep fibular nerve	Anterior compartment of leg and skin over webspace between 1st and 2nd toes

Motor supply

Muscle	Action(s)	Innervation
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch	Superficial fibular nerve (L5 – S2)
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)

Sensory supply



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Anatomy: Leg and Foot



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The skin over the medial side and sole of heel is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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Anatomy: Leg and Foot

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The skin over the medial side and sole of heel is primarily supplied by which of the following nerves:

a) Sural nerve
b) Common fibular nerve
c) **Tibial nerve** ✔
d) Saphenous nerve
e) Superficial fibular nerve

Answer

The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.

Notes

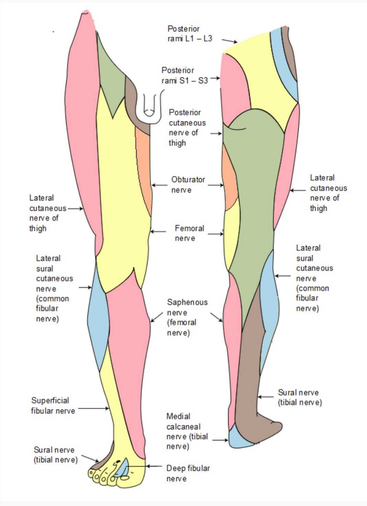
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

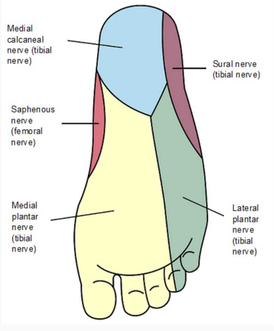
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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The tibialis posterior muscle is innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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The tibialis posterior muscle is innervated by which of the following nerves:

a) Common fibular nerve
b) Sciatic nerve
c) Deep fibular nerve
d) Superficial fibular nerve
e) **Tibial nerve** ✔

Answer

The tibialis posterior is innervated by the tibial nerve (L4, L5).

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

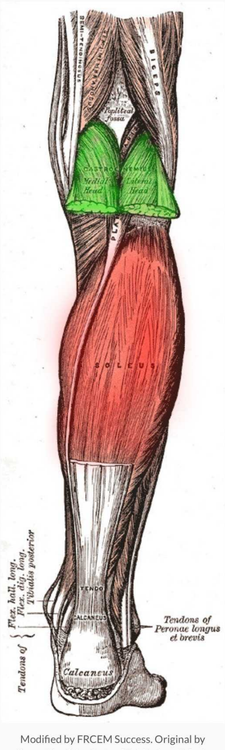
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

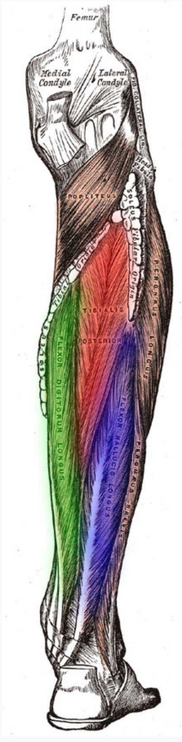
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 64 of 110

Which of the following bones are involved in articulations at the knee joint:

a The tibia, fibular and patella

b The tibia, fibular and femur

c The tibia and femur

d The tibia, fibular, femur and patella

e The tibia, femur and patella

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a) The tibia, fibular and patella
b) The tibia, fibular and femur
c) The tibia and femur
d) The tibia, fibular, femur and patella
e) **The tibia, femur and patella** ✔

Answer

The knee joint is formed from two articulations, the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles and the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

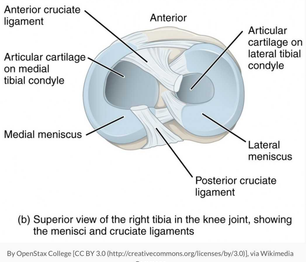
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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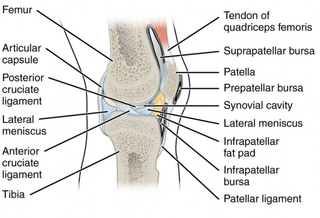
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 65 of 110

A 28 year old man presents to hospital having injured his leg playing football. X-ray demonstrates fractures of both the tibia and fibula. The patient demonstrates foot drop, but has normal eversion of the foot. Which of the following nerves has most likely been injured:

a Tibial nerve

b Common fibular nerve

c Deep fibular nerve

d Superficial fibular nerve

e Sural nerve

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a) Tibial nerve
b) Common fibular nerve
c) **Deep fibular nerve** ✔
d) Superficial fibular nerve
e) Sural nerve

Answer

Foot drop (loss of dorsiflexion) results from paralysis of the anterior leg muscles, innervated by the deep fibular nerve. Eversion is produced primarily by the fibularis longus and brevis, innervated by the superficial fibular nerve. Eversion in this case is normal, thus the superficial fibular nerve is unaffected and therefore the common fibular nerve is intact. The sural nerve is a cutaneous branch of the tibial nerve. The tibial nerve innervates the posterior leg muscles, responsible for plantarflexion of the foot and flexion of the toes.

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

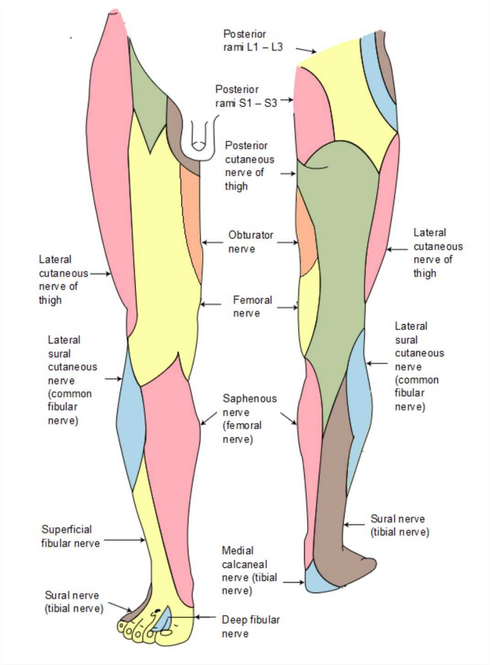
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



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A 30 year old male was hit by a car in his lateral knee joint region. Which of the following structures is most likely injured:

a Anterior cruciate ligament

b Posterior cruciate ligament

c Patella fracture

d Lateral meniscus

e Deltoid ligament

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a) Anterior cruciate ligament ✔
b) Posterior cruciate ligament
c) Patella fracture
d) **Lateral meniscus** ✖
e) Deltoid ligament

Answer

This type of injury can result in the 'unhappy triad' injury with damage to the tibial collateral ligament, anterior cruciate ligament and medial meniscus. A blow to the lateral side of the knee stretches and tears the tibial collateral ligament, which is attached to the medial meniscus. The anterior cruciate ligament is tensed during knee extension and can tear subsequent to rupture of the tibial collateral ligament.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

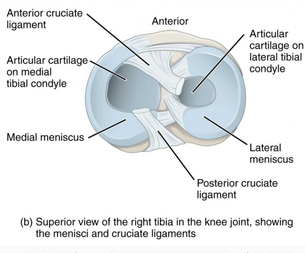
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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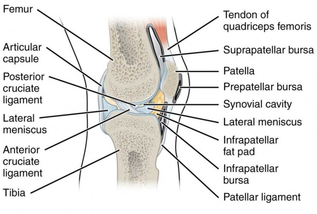
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 67 of 110

The fibularis longus muscle is innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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Question 67 of 110

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a) Common fibular nerve
b) Sciatic nerve
c) Deep fibular nerve
d) **Superficial fibular nerve** ✔
e) Tibial nerve

Answer

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

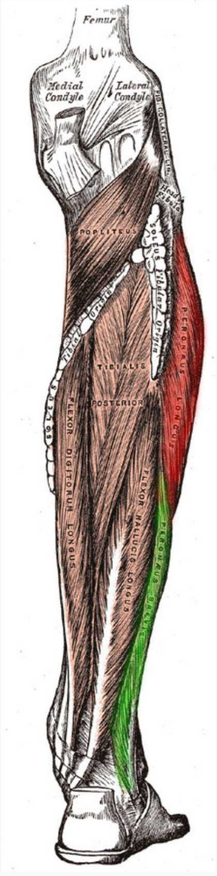
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 68 of 110

The spring ligament is attached to which of the following bones:

a Talus and navicular

b Calcaneus and talus

c Calcaneus and navicular

d Calcaneus and cuboid

e Talus and cuboid

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Question 68 of 110

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d) Calcaneus and cuboid
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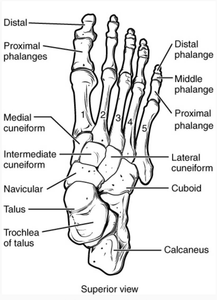
Answer

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

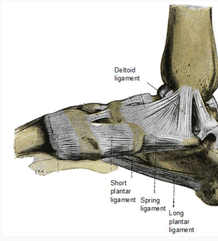
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

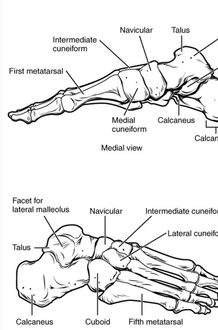
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 69 of 110

Which of the following bones does not help to form the lateral longitudinal arch:

a Calcaneus

b Cuboid

c 5th metatarsal

d 4th metatarsal

e Lateral cuneiform

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Which of the following bones does not help to form the lateral longitudinal arch:

a) Calcaneus
b) Cuboid
c) 5th metatarsal
d) 4th metatarsal
e) **Lateral cuneiform** ✔

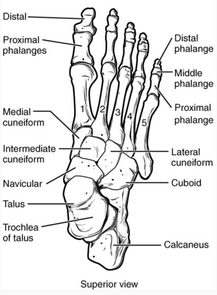
Answer

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
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Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

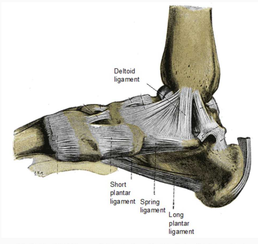
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

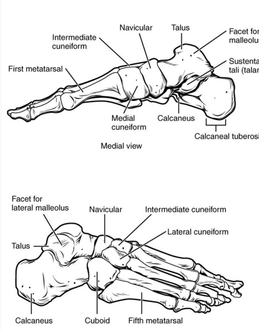
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Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
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Anatomy: Leg and Foot



Question 70 of 110

Which of the following bones does not help to form the medial longitudinal arch:

a Calcaneus

b Talus

c Navicular

d Lateral cuneiform

e Cuboid

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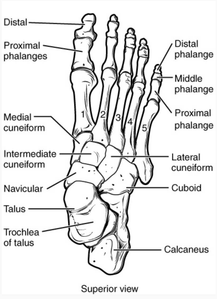
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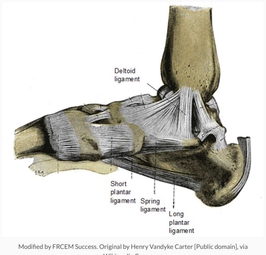
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Foot arches

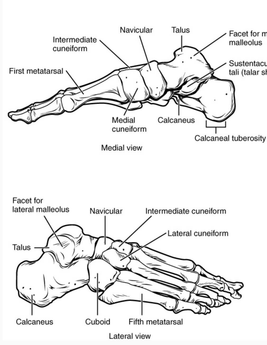
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Anatomy: Leg and Foot



Question 71 of 110

The gastrocnemius muscle is innervated by which of the following nerves:

a Sciatic nerve

b Tibial nerve

c Common fibular nerve

d Deep fibular nerve

e Superficial fibular nerve

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Anatomy: Leg and Foot

Question 71 of 110

The gastrocnemius muscle is innervated by which of the following nerves:

a) Sciatic nerve
b) **Tibial nerve** ✔
c) Common fibular nerve
d) Deep fibular nerve
e) Superficial fibular nerve

Answer

The gastrocnemius is innervated by the tibial nerve (S1, S2).

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

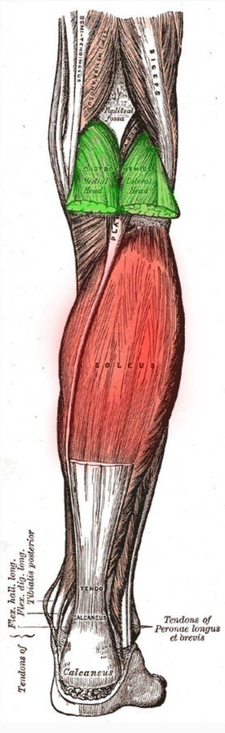
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

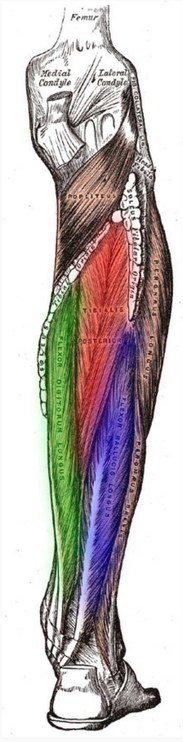
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 72 of 110

The skin over the dorsum of the foot is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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Question 72 of 110

The skin over the dorsum of the foot is primarily supplied by which of the following nerves:

a) Sural nerve
b) Common fibular nerve
c) Tibial nerve
d) Saphenous nerve
e) **Superficial fibular nerve** ✔

Answer

The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).

Notes

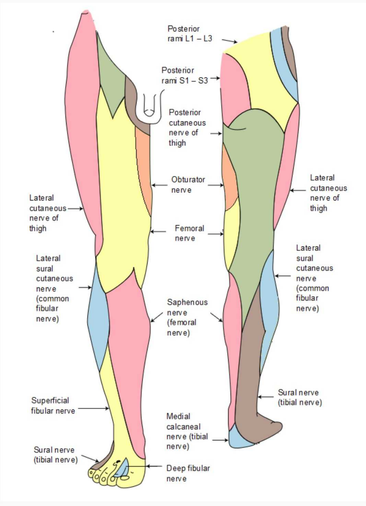
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

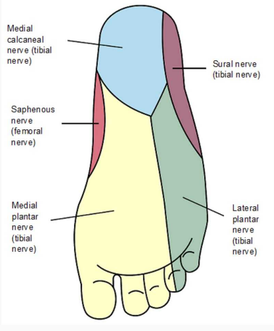
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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Anatomy: Leg and Foot



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Which of the following nerves are most important for inversion of the foot:

a Tibial and superficial fibular nerve

b Deep fibular and superficial fibular nerve

c Tibial and deep fibular nerve

d Common peroneal nerve

e Tibial and obturator nerve

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Anatomy: Leg and Foot

Question 73 of 110

Which of the following nerves are most important for inversion of the foot:

a) Tibial and superficial fibular nerve
b) Deep fibular and superficial fibular nerve
c) **Tibial and deep fibular nerve** ✔
d) Common peroneal nerve
e) Tibial and obturator nerve

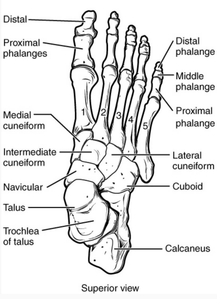
Answer

Inversion of the foot is primarily produced by the tibialis anterior and the tibialis posterior muscles, innervated by the deep fibular nerve and the tibial nerve respectively.

Notes

Tarsal bones

There are three groups of bones in the foot; the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

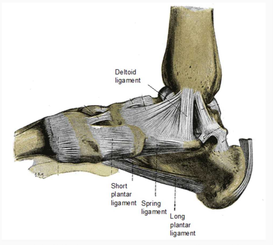
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

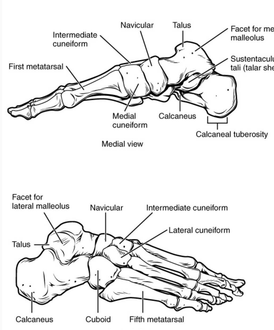
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 74 of 110

The deep fibular nerve receives nerve fibres from which of the following nerve roots:

a L4 – S1

b L2 – L5

c L5, S1

d L4 – L5

e L3 – S1

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The deep fibular nerve receives nerve fibres from which of the following nerve roots:

a) L4 – S1
b) L2 – L5
c) L5, S1
d) **L4 – L5** ✔
e) L3 – S1

Answer

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

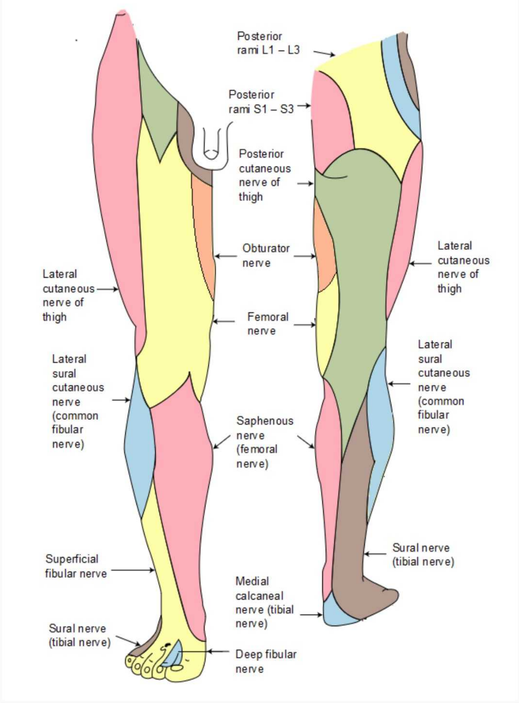
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



Question 75 of 110

The soleus muscle acts to produce which of the following movements:

a Plantarflexion of the foot

b Dorsiflexion of the foot

c Eversion of the foot

d Inversion of the foot

e Plantarflexion and eversion of the foot

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The soleus muscle acts to produce which of the following movements:

a) **Plantarflexion of the foot** ✔
b) Dorsiflexion of the foot
c) Eversion of the foot
d) Inversion of the foot
e) Plantarflexion and eversion of the foot

Answer

The soleus plantarflexes the foot at the ankle.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

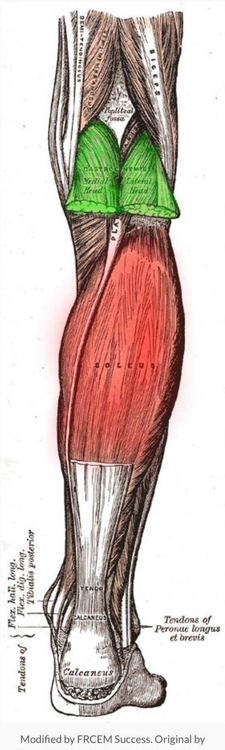
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

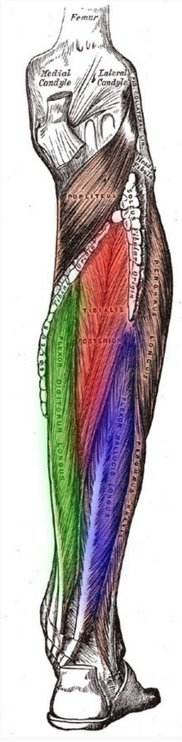
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Question 76 of 110

A 32 year old landscape gardener has an accident with his tools at work. He sustains a deep laceration that severs the superficial fibular nerve near its origin. Which of the following muscles is most likely affected:

a Tibialis anterior

b Tibialis posterior

c Fibularis tertius

d Fibularis longus

e Extensor hallucis longus

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A 32 year old landscape gardener has an accident with his tools at work. He sustains a deep laceration that severs the superficial fibular nerve near its origin. Which of the following muscles is most likely affected:

a) Tibialis anterior
b) Tibialis posterior
c) Fibularis tertius
d) **Fibularis longus** ✔
e) Extensor hallucis longus

Answer

The superficial fibular nerve innervates the lateral compartment of the leg – the fibularis longus and fibularis brevis muscles, responsible for eversion of the foot.

Notes

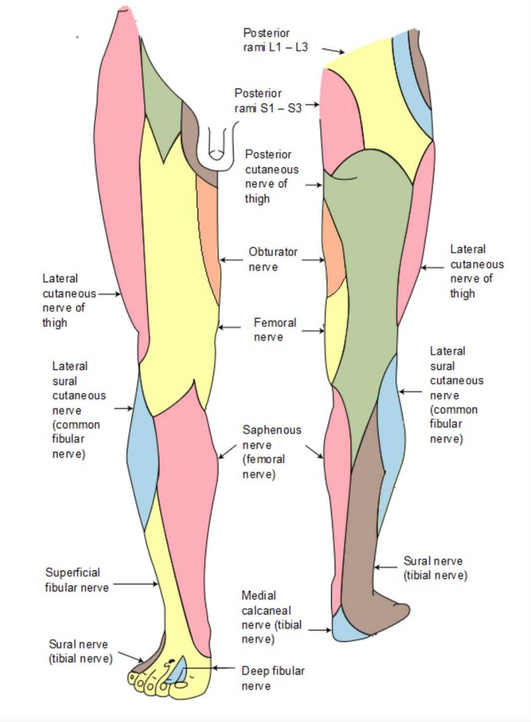
The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Nerve	Superficial fibular nerve
Nerve roots	L4 – S1
Motor supply	Lateral compartment of leg
Sensory supply	Lower anterolateral leg and dorsum of foot
Injury	Loss of eversion of the foot and loss of sensation over the lower anterolateral leg and dorsum of foot

It innervates the fibularis longus and the fibularis brevis in the lateral leg. It supplies the skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd digit supplied by the deep fibular nerve, and the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Motor supply

Muscle	Action(s)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch
Fibularis brevis	Eversion of foot



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The 'screw home' mechanism involved in locking of the knee joint refers to which of the following actions:

a Slight superior displacement of the patella on the femur in extension

b Medial rotation of the femur on the tibia in extension of the leg

c Lateral rotation of the femur on the tibia in extension of the leg

d Medial displacement of the femur on the tibia in extension of the leg

e Lateral displacement of the femur on the tibia in extension of the leg

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Question 77 of 110

The 'screw home' mechanism involved in locking of the knee joint refers to which of the following actions:

a) Slight superior displacement of the patella on the femur in extension
b) **Medial rotation of the femur on the tibia in extension of the leg** ✔
c) Lateral rotation of the femur on the tibia in extension of the leg
d) Medial displacement of the femur on the tibia in extension of the leg
e) Lateral displacement of the femur on the tibia in extension of the leg

Answer

When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism).

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

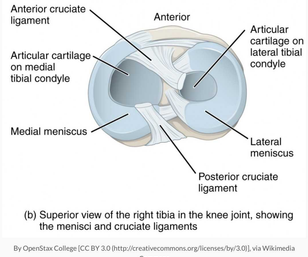
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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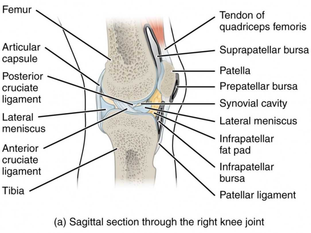
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 78 of 110

Which of the following synovial joint types best describes the knee joint:

a Synovial modified hinge joint

b Synovial pivot joint

c Synovial saddle joint

d Synovial hinge joint

e Synovial ball and socket joint

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Anatomy: Leg and Foot



Question 78 of 110

Which of the following synovial joint types best describes the knee joint:

a) Synovial modified hinge joint ✔
b) Synovial pivot joint
c) Synovial saddle joint
d) **Synovial hinge joint** ✖
e) Synovial ball and socket joint

Answer

The knee joint is a modified hinge synovial joint.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

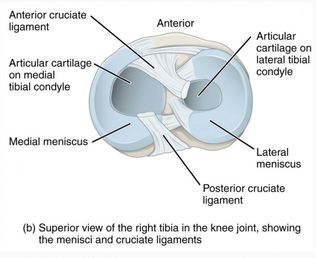
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Joint capsule

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Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



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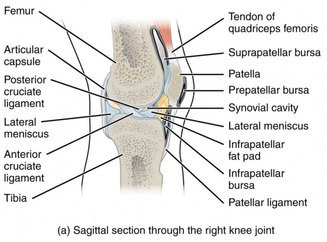
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Anatomy: Leg and Foot



Question 79 of 110

Superficial fibular nerve palsy results in which of the following clinical features:

a Loss of eversion of the foot

b Loss of inversion of the foot

c Loss of dorsiflexion of the foot

d Loss of plantarflexion of the foot

e Loss of eversion and weakness of dorsiflexion of the foot

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Anatomy: Leg and Foot

Question 79 of 110

Superficial fibular nerve palsy results in which of the following clinical features:

a) **Loss of eversion of the foot** ✔
b) Loss of inversion of the foot
c) Loss of dorsiflexion of the foot
d) Loss of plantarflexion of the foot
e) Loss of eversion and weakness of dorsiflexion of the foot

Answer

Damage to the superficial fibular nerve results in loss of eversion of the foot and loss of sensation over the lower anterolateral leg and the dorsum of the foot.

Notes

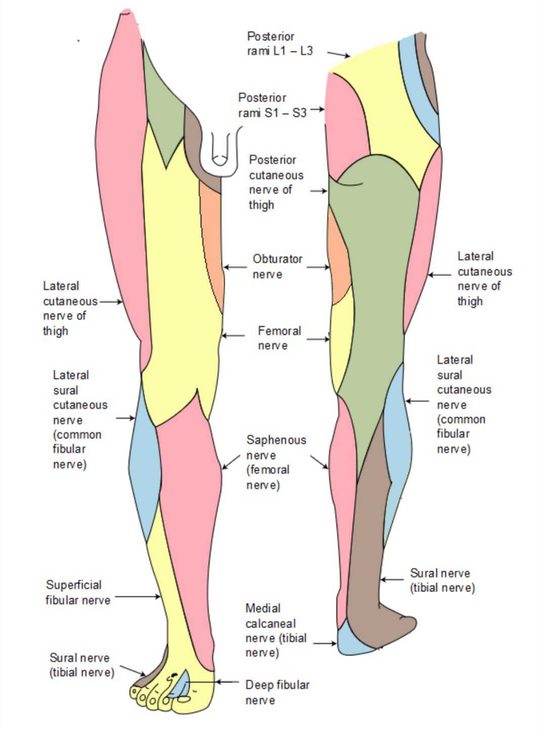
The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Nerve	Superficial fibular nerve
Nerve roots	L4 – S1
Motor supply	Lateral compartment of leg
Sensory supply	Lower anterolateral leg and dorsum of foot
Injury	Loss of eversion of the foot and loss of sensation over the lower anterolateral leg and dorsum of foot

It innervates the fibularis longus and the fibularis brevis in the lateral leg. It supplies the skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd digit supplied by the deep fibular nerve, and the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Motor supply

Muscle	Action(s)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch
Fibularis brevis	Eversion of foot



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Anatomy: Leg and Foot



Question 80 of 110

The plantar arteries and nerves lie within which of the muscular layers of the sole of the foot:

a Superficial to the first layer

b Between the first and second layer

c Between the second and third layer

d Between the third and fourth layer

e Deep to the fourth layer

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Anatomy: Leg and Foot



Question 80 of 110

The plantar arteries and nerves lie within which of the muscular layers of the sole of the foot:

a) Superficial to the first layer
b) **Between the first and second layer** ✔
c) Between the second and third layer
d) Between the third and fourth layer
e) Deep to the fourth layer

Answer

The plantar arteries and nerves lie between the first and second layers.

Notes

The muscles in the sole of the foot are organised into four layers. Detailed knowledge of the muscles which lie within a given layer is not required, but the following is required knowledge and has implications for the structures likely to compromised when the sole is injured.

The plantar arteries and nerves lie between the first and second layers.

The long flexor tendons of the flexor hallucis longus and flexor digitorum longus muscles lie within the second layer.

The tendons of the tibialis posterior and fibularis longus muscles are part of the fourth layer.

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Anatomy: Leg and Foot



Question 81 of 110

Which one of the following muscles is NOT innervated by the deep fibular nerve:

a Fibularis tertius

b Tibialis anterior

c Extensor hallucis longus

d Extensor digitorum longus

e Fibularis longus

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Anatomy: Leg and Foot

Question 81 of 110

Which one of the following muscles is NOT innervated by the deep fibular nerve:

a) Fibularis tertius
b) **Tibialis anterior** ✗
c) Extensor hallucis longus
d) Extensor digitorum longus
e) Fibularis longus ✓

Answer

The deep fibular nerve supplies the muscles in the anterior compartment of the leg. The fibularis longus is in the lateral compartment of the leg and innervated by the superficial fibular nerve.

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

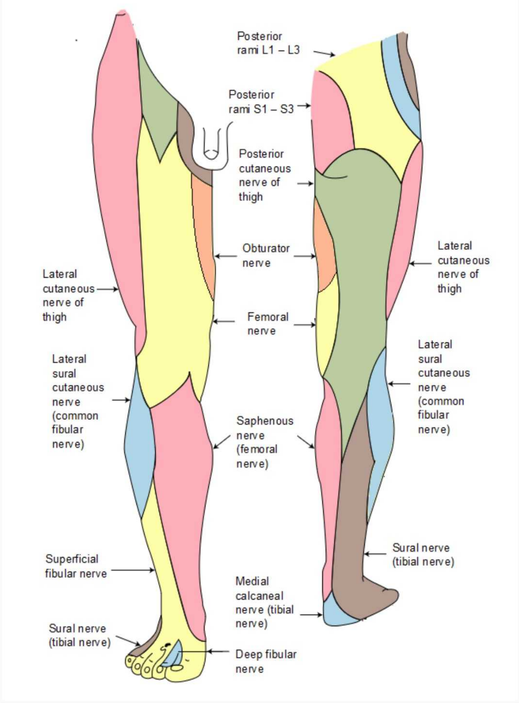
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



Question 82 of 110

You are demonstrating a vascular examination to group of medical students. The dorsalis pedis artery pulse is best palpated at which of the following sites:

a Posterior and inferior to the medial malleolus

b Dorsum of the foot between the tendons of the extensor digitorum longus to the 2nd and 3rd toes.

c Dorsum of the foot just lateral to the extensor hallucis longus tendon

d Dorsum of the foot between the tendons of the tibialis anterior and the extensor hallucis longus

e Dorsum of the foot over the lateral cuneiform

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Anatomy: Leg and Foot

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a) Posterior and inferior to the medial malleolus
b) Dorsum of the foot between the tendons of the extensor digitorum longus to the 2nd and 3rd toes.
c) **Dorsum of the foot just lateral to the extensor hallucis longus tendon** ✔
d) Dorsum of the foot between the tendons of the tibialis anterior and the extensor hallucis longus
e) Dorsum of the foot over the lateral cuneiform

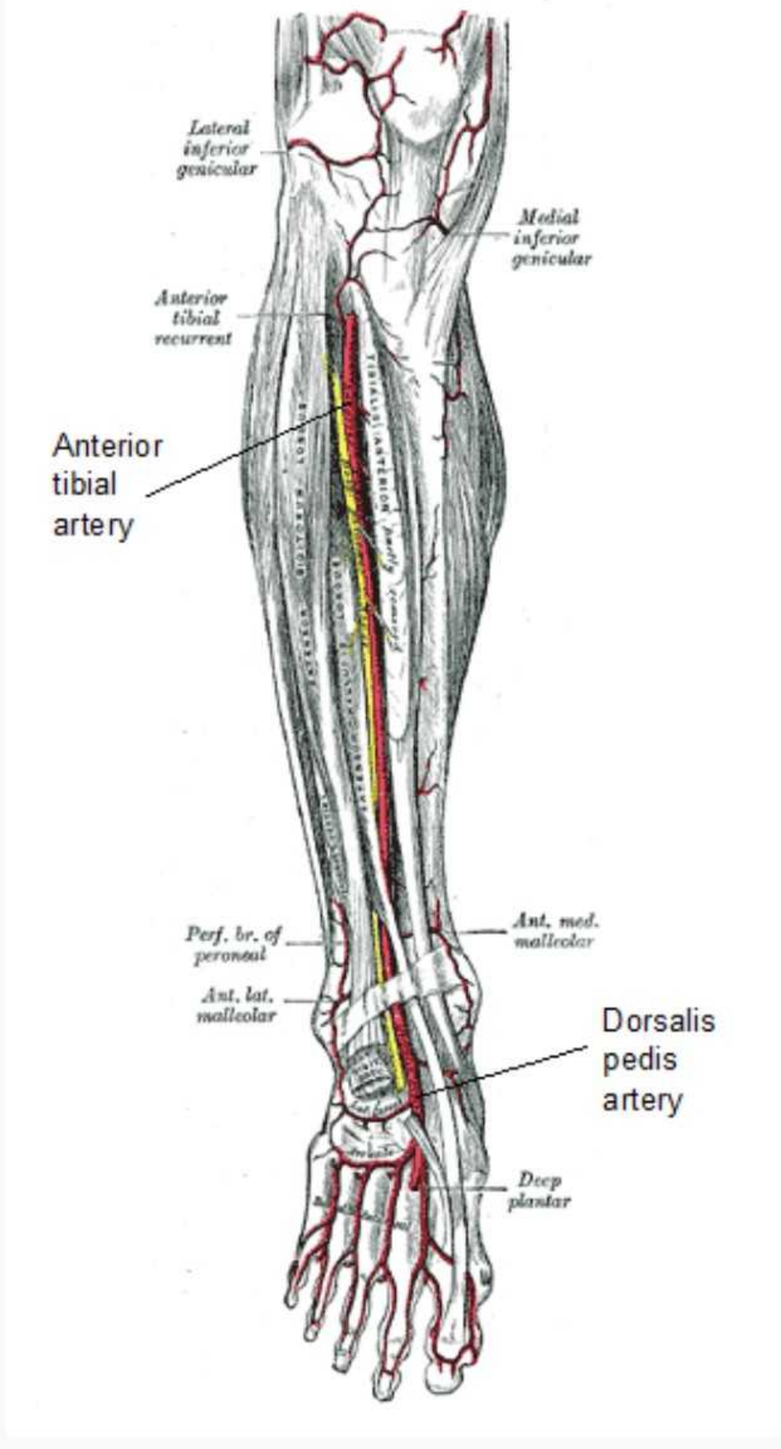
Answer

The dorsalis pedis pulse can be palpated on the dorsal surface of the foot between the tendon of the extensor hallucis longus and the tendon of the extensor digitorum longus to the second toe.

Notes

The dorsalis pedis artery begins as the anterior tibial artery crosses the ankle joint. It passes anteriorly over the dorsal aspect of the tarsal bones and then passes inferiorly to join the deep plantar arch in the sole of the foot along with branches from the posterior tibial artery.

The dorsalis pedis pulse can be palpated on the dorsal surface of the foot between the tendon of the extensor hallucis longus and the tendon of the extensor digitorum longus to the second toe.



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Anatomy: Leg and Foot



Question 83 of 110

The tibialis posterior muscle acts to produce which of the following movements:

a Inversion and plantarflexion of the foot

b Eversion and plantarflexion of the foot

c Inversion and dorsiflexion of the foot

d Eversion and dorsiflexion of the foot

e Flexion of the leg and plantarflexion of the foot

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Anatomy: Leg and Foot

Question 83 of 110

The tibialis posterior muscle acts to produce which of the following movements:

a) Inversion and plantarflexion of the foot ✔
b) Eversion and plantarflexion of the foot
c) Inversion and dorsiflexion of the foot
d) Eversion and dorsiflexion of the foot
e) Flexion of the leg and plantarflexion of the foot

Answer

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

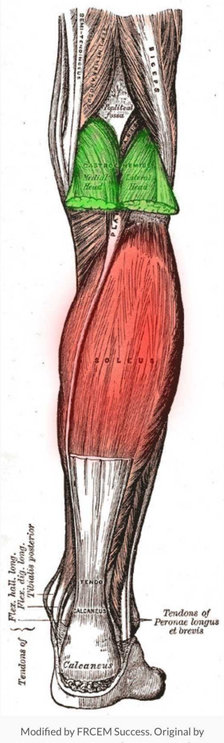
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

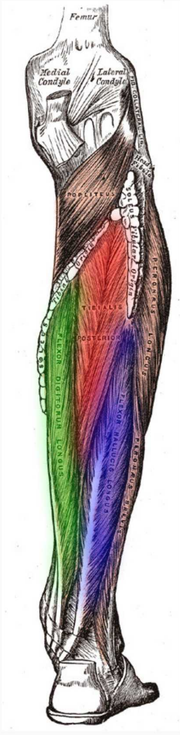
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 84 of 110

Which of the following muscles is NOT found in the anterior compartment of the leg:

a Tibialis anterior

b Extensor hallucis longus

c Extensor digitorum longus

d Fibularis tertius

e Fibularis brevis

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Anatomy: Leg and Foot

Question 84 of 110

Which of the following muscles is NOT found in the anterior compartment of the leg:

a) Tibialis anterior
b) Extensor hallucis longus
c) Extensor digitorum longus
d) Fibularis tertius
e) **Fibularis brevis** ✔

Answer

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius.

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

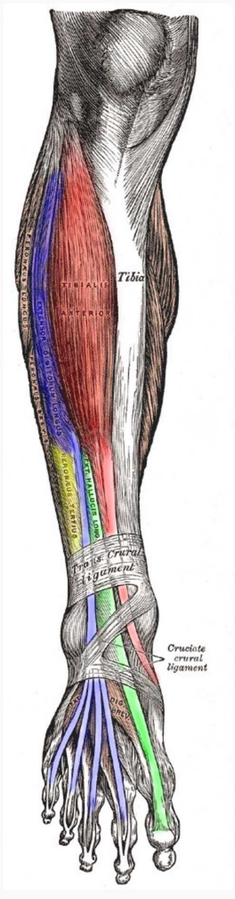
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

The extensor hallucis longus (green) extends the great toe and dorsiflexes the foot at the ankle joint.

The extensor digitorum longus (blue) extends the lateral four toes and dorsiflexes the foot at the ankle.

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



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The navicular bone articulates with all of the following bones except for the:

a The talus

b The calcaneus

c The medial cuneiform

d The intermediate cuneiform

e The lateral cuneiform

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Anatomy: Leg and Foot

Question 85 of 110

The navicular bone articulates with all of the following bones except for the:

a) The talus ✗
b) The calcaneus ✓
c) The medial cuneiform
d) The intermediate cuneiform
e) The lateral cuneiform

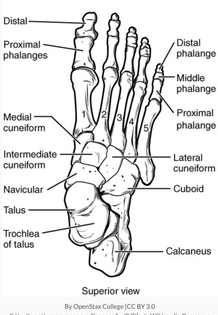
Answer

The navicular articulates with the talus posteriorly and the cuboid and three cuneiforms anteriorly.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

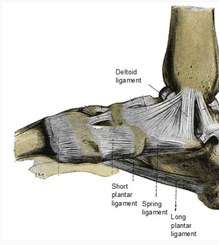
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

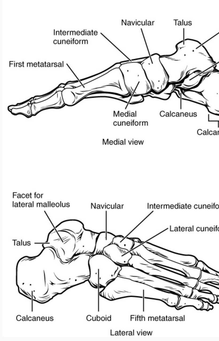
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 86 of 110

The skin over the lower posterolateral leg is primarily supplied by which of the following nerves:

a Sural nerve

b Common fibular nerve

c Deep fibular nerve

d Saphenous nerve

e Superficial fibular nerve

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Anatomy: Leg and Foot

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The skin over the lower posterolateral leg is primarily supplied by which of the following nerves:

a) **Sural nerve** ✔
b) Common fibular nerve
c) Deep fibular nerve
d) Saphenous nerve
e) Superficial fibular nerve

Answer

The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.

Notes

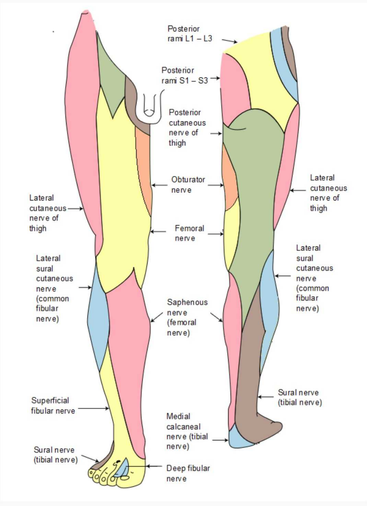
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

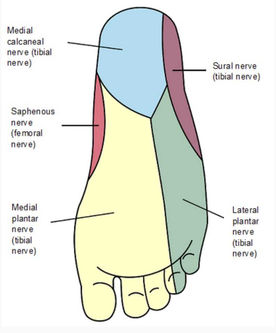
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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Anatomy: Leg and Foot



Question 87 of 110

The fibularis tertius muscle acts to produce which of the following movements:

a Plantarflexion and inversion of the foot

b Plantarflexion and eversion of the foot

c Dorsiflexion and eversion of the foot

d Dorsiflexion and inversion of the foot

e Dorsiflexion of the foot and extension of the toes

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The fibularis tertius muscle acts to produce which of the following movements:

a) Plantarflexion and inversion of the foot
b) **Plantarflexion and eversion of the foot** ✖
c) Dorsiflexion and eversion of the foot ✔
d) Dorsiflexion and inversion of the foot
e) Dorsiflexion of the foot and extension of the toes

Answer

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

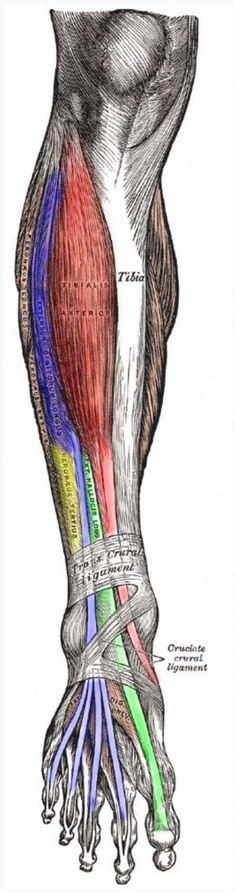
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

The extensor hallucis longus (green) extends the great toe and dorsiflexes the foot at the ankle joint.

The extensor digitorum longus (blue) extends the lateral four toes and dorsiflexes the foot at the ankle.

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



Question 88 of 110

A 21 year old gang member presents to ED having been shot in the foot. Imaging shows severe damage to the base of the fifth metatarsal with damage to the muscle tendon attached here. Which of the following movements would you most expect to be affected:

a Plantarflexion of the foot

b Dorsiflexion of the foot

c Eversion of the foot

d Inversion of the foot

e Extension of the little toe

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A 21 year old gang member presents to ED having been shot in the foot. Imaging shows severe damage to the base of the fifth metatarsal with damage to the muscle tendon attached here. Which of the following movements would you most expect to be affected:

a) Plantarflexion of the foot
b) Dorsiflexion of the foot
c) **Eversion of the foot** ✔
d) Inversion of the foot
e) Extension of the little toe

Answer

The fibularis brevis muscle tendon attaches distally to a tubercle on the lateral surface of the base of the 5th metatarsal. Damage to this muscle will result in weakened eversion of the foot. (N.B. the fibularis tertius muscle tendon also attaches to the dorsal aspect of the fifth metatarsal – this muscle also acts to evert the foot, and assists very weakly with dorsiflexion).

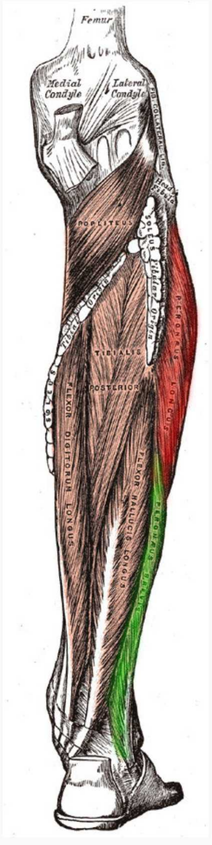
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 89 of 110

The tibialis anterior muscle acts to produce which of the following movements:

a Dorsiflexion and inversion of the foot

b Dorsiflexion and eversion of the foot

c Plantarflexion and inversion of the foot

d Plantarflexion and eversion of the foot

e Dorsiflexion (and acts to stabilise the lateral arch of the foot)

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The tibialis anterior muscle acts to produce which of the following movements:

a) **Dorsiflexion and inversion of the foot** ✔
b) Dorsiflexion and eversion of the foot
c) Plantarflexion and inversion of the foot
d) Plantarflexion and eversion of the foot
e) Dorsiflexion (and acts to stabilise the lateral arch of the foot)

Answer

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

Notes

The anterior compartment of the leg is made up of four muscles: the tibialis anterior, the extensor hallucis longus, the extensor digitorum longus and the fibularis tertius which collectively dorsiflex the foot at the ankle joint. These muscles are all innervated by the deep fibular nerve.

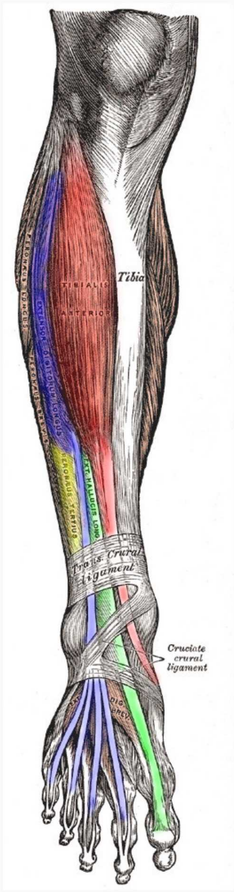
Muscle	Action(s)	Innervation
Tibialis anterior (red)	Dorsiflexion and inversion of foot, support of medial arch of foot	Deep fibular nerve (L4, L5)
Extensor hallucis longus (green)	Extension of great toe and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Extensor digitorum longus (blue)	Extension of lateral four toes and dorsiflexion of foot	Deep fibular nerve (L5, S1)
Fibularis tertius (green)	Dorsiflexion and eversion of foot	Deep fibular nerve (L5, S1)

The tibialis anterior (red) dorsiflexes the foot at the ankle, inverts the foot at the intertarsal joints and provides dynamic support of the medial arch of the foot while walking.

The extensor hallucis longus (green) extends the great toe and dorsiflexes the foot at the ankle joint.

The extensor digitorum longus (blue) extends the lateral four toes and dorsiflexes the foot at the ankle.

The fibularis tertius (green), sometimes considered part of the extensor digitorum longus, assists in dorsiflexion and eversion of the foot.



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Anatomy: Leg and Foot



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The superficial fibular nerve receives nerve fibres from which of the following nerve roots:

a L4 – S1

b L2 – L5

c L5, S1 – S2

d L4, L5

e L3 – S1

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The superficial fibular nerve receives nerve fibres from which of the following nerve roots:

a) L4 – S1 ✔
b) L2 – L5
c) L5, S1 – S2
d) L4, L5
e) L3 – S1

Answer

The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Notes

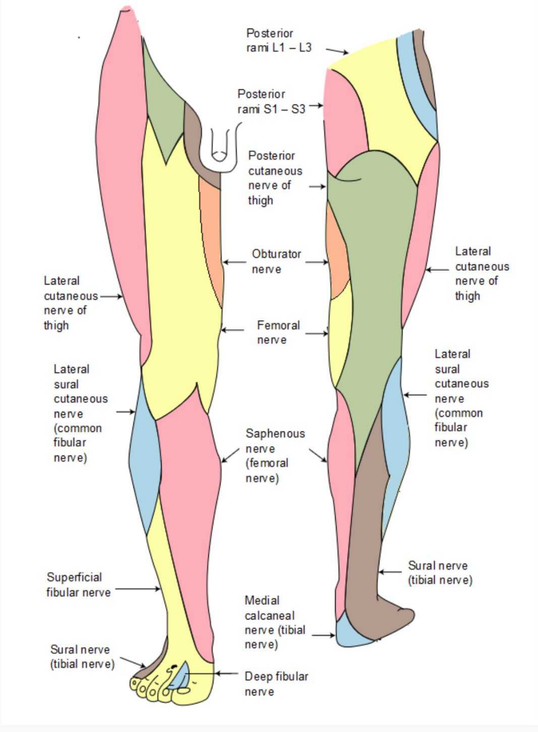
The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Nerve	Superficial fibular nerve
Nerve roots	L4 – S1
Motor supply	Lateral compartment of leg
Sensory supply	Lower anterolateral leg and dorsum of foot
Injury	Loss of eversion of the foot and loss of sensation over the lower anterolateral leg and dorsum of foot

It innervates the fibularis longus and the fibularis brevis in the lateral leg. It supplies the skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd digit supplied by the deep fibular nerve, and the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Motor supply

Muscle	Action(s)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch
Fibularis brevis	Eversion of foot



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The fibularis brevis muscle is innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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The fibularis brevis muscle is innervated by which of the following nerves:

a) Common fibular nerve
b) Sciatic nerve
c) Deep fibular nerve
d) **Superficial fibular nerve** ✔
e) Tibial nerve

Answer

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

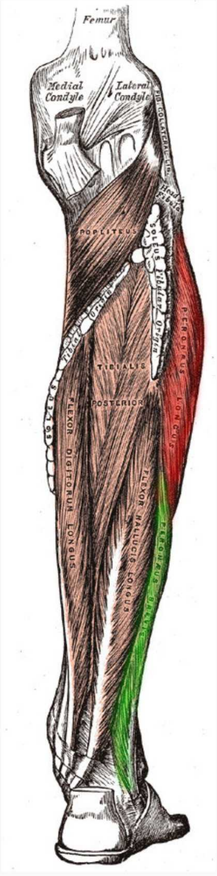
Notes

Muscle	Action(s)	Innervation	Distal attachment
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arches	Superficial fibular nerve (L5 – S2)	1st metatarsal and medial cuneiform
Fibularis brevis	Eversion of foot	Superficial fibular nerve (L5 – S2)	5th metatarsal

The fibularis longus and brevis act together to evert the foot. The fibularis longus also assists in plantarflexion of the foot and supports the arches of the foot (mainly the lateral and transverse arches).

Both the fibularis longus and brevis are innervated by the superficial fibular nerve (L5 – S2).

Both tendons of the fibularis longus and brevis pass posterior to the lateral malleolus in a shallow bony groove before swinging forward to enter the lateral side of the foot. The fibularis brevis then curves forward across the lateral surface of the calcaneus to attach to a tubercle on the lateral surface of the base of the 5th metatarsal. The fibularis longus descends obliquely down the lateral side of the foot before swinging under the foot to cross the sole and attach to the inferior surfaces of the base of the 1st metatarsal and the medial cuneiform bones.



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Anatomy: Leg and Foot



Question 92 of 110

The gastrocnemius muscle acts to produce which of the following movements:

a Flexion of the leg and plantarflexion of the foot

b Plantarflexion of the foot alone

c Flexion of the leg alone

d Plantarflexion and inversion of the foot

e Flexion of the leg and dorsiflexion of the foot

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Anatomy: Leg and Foot

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The gastrocnemius muscle acts to produce which of the following movements:

a) Flexion of the leg and plantarflexion of the foot ✔
b) **Plantarflexion of the foot alone** ✖
c) Flexion of the leg alone
d) Plantarflexion and inversion of the foot
e) Flexion of the leg and dorsiflexion of the foot

Answer

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

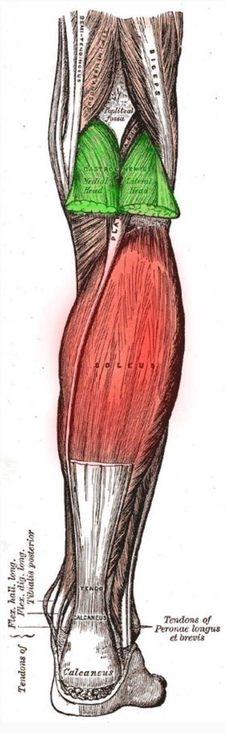
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

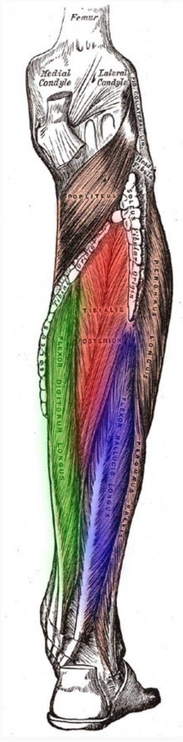
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 93 of 110

Which of the following nerves is most important for eversion of the foot:

a Tibial nerve

b Saphenous nerve

c Superficial fibular nerve

d Deep fibular nerve

e Sural nerve

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Anatomy: Leg and Foot

Question 93 of 110

Which of the following nerves is most important for eversion of the foot:

a) Tibial nerve
b) Saphenous nerve
c) **Superficial fibular nerve** ✔
d) Deep fibular nerve
e) Sural nerve

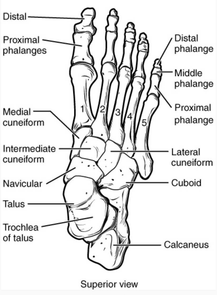
Answer

Eversion of the foot is primarily produced by the fibularis longus and fibularis brevis, both innervated by the superficial fibular nerve. The fibularis tertius, innervated by the deep fibular nerve, also assists in this action.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

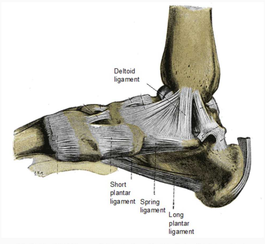
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

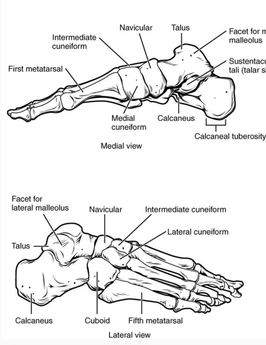
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 94 of 110

The muscles of the posterior leg are all innervated by which of the following nerves:

a Common fibular nerve

b Sciatic nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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Anatomy: Leg and Foot

Question 94 of 110

The muscles of the posterior leg are all innervated by which of the following nerves:

a) Common fibular nerve
b) Sciatic nerve
c) Deep fibular nerve
d) Superficial fibular nerve
e) **Tibial nerve** ✔

Answer

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

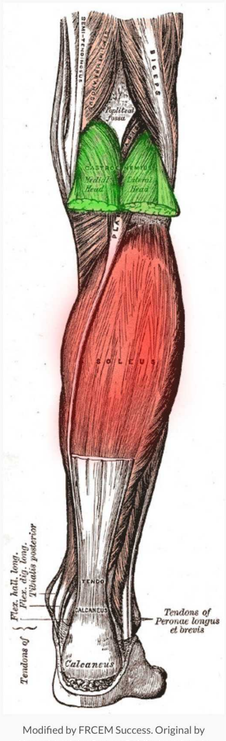
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

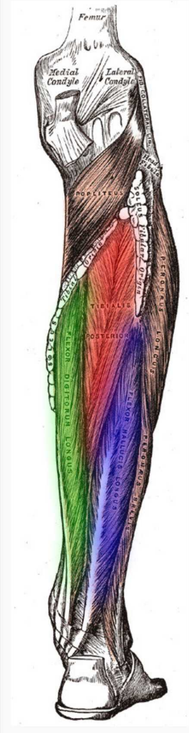
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 95 of 110

Which one of the following muscles is most important in 'unlocking' the knee from the extended position:

a Sartorius

b Gracilis

c Popliteus

d Plantaris

e Gastrocnemius

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Anatomy: Leg and Foot



Question 95 of 110

Which one of the following muscles is most important in 'unlocking' the knee from the extended position:

a) Sartorius
b) Gracilis
c) **Popliteus** ✔
d) Plantaris
e) Gastrocnemius

Answer

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint.

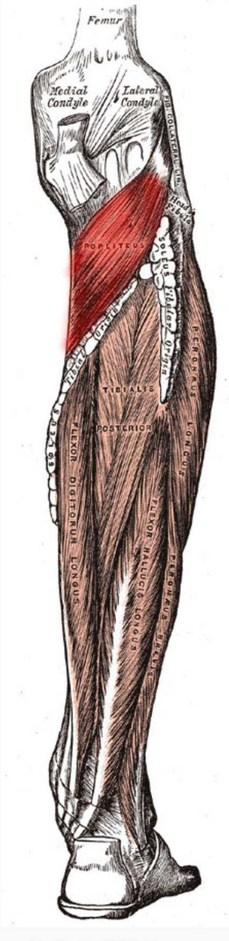
Notes

The popliteus muscle is the smallest and most superior of the deep muscles in the posterior compartment of the leg.

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint. It stabilises the knee by resisting lateral rotation of the tibia on the femur.

The popliteus muscle is also attached to the lateral meniscus in the knee and draws it posteriorly during knee flexion thus preventing its entrapment.

The popliteus is innervated by the tibial nerve (L4 – S1).



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Anatomy: Leg and Foot



Question 96 of 110

The cuneiform bones articulate with which of the following bones:

a The calcaneus and the medial three metatarsals

b The talus and the medial three metatarsals

c The navicular and the lateral three metatarsals

d The medial three metatarsals and the cuboid

e The navicular, the cuboid and the medial three metatarsals

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The cuneiform bones articulate with which of the following bones:

a) The calcaneus and the medial three metatarsals
b) The talus and the medial three metatarsals
c) The navicular and the lateral three metatarsals
d) The medial three metatarsals and the cuboid
e) **The navicular, the cuboid and the medial three metatarsals** ✔

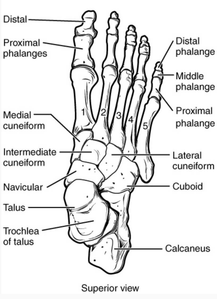
Answer

The cuneiform bones articulate with the navicular posteriorly and the medial three metatarsals anteriorly. The lateral cuneiform also articulates with the cuboid laterally.

Notes

Tarsal bones

There are three groups of bones in the foot; the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

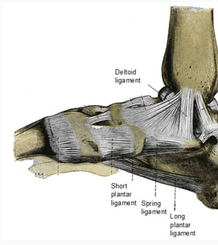
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

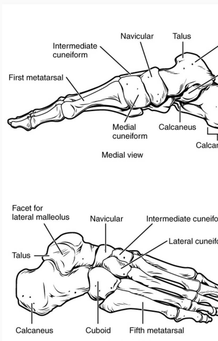
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 97 of 110

Which of the following nerves is most important for dorsiflexion of the foot at the ankle joint:

a Tibial nerve

b Deep fibular nerve

c Superficial fibular nerve

d Saphenous nerve

e Sural nerve

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Which of the following nerves is most important for dorsiflexion of the foot at the ankle joint:

a) Tibial nerve
b) **Deep fibular nerve** ✔
c) Superficial fibular nerve
d) Saphenous nerve
e) Sural nerve

Answer

Dorsiflexion at the ankle is primarily performed by the muscles in the anterior compartment of the leg, innervated by the deep fibular nerve.

Notes

Joint	Ankle joint
Type	Synovial hinge joint
Articulations	Talus with the inferior tibia and talus with the medial malleolus of the tibia and the lateral malleolus of the fibula
Stabilising factors	Shape of talus bone and articulations with malleoli, Medial and lateral collateral ligaments
Movements	Flexion and extension

Joint articulations

The ankle joint is a hinge type synovial joint formed between the distal ends of the tibia and fibula, and the superior part of the talus.

The tibia and fibula are bound together by strong tibiofibular ligaments forming a deep bracket-shaped socket, which the talus bone then fits into. The talus bone articulates with the tibia in two places; the inferior surface of the tibia forms the roof of the socket and its medial malleolus articulates with the medial surface of the talus bone. The lateral malleolus of the fibula articulates with the lateral surface of the talus bone. The articulation of the talus with the inferior tibia forms the weightbearing surface and the articulations of the talus with the malleoli act to stabilise the joint.

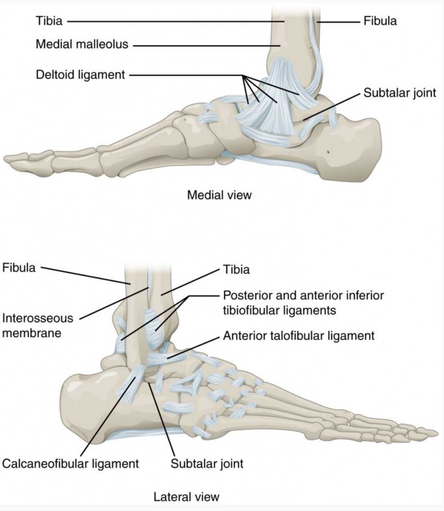
The articular surface of the talus is much wider anteriorly than it is posteriorly, therefore the bone fits more tightly in the socket when the foot is dorsiflexed (and the wider surface of the talus moves into the ankle joint), making the joint more stable in dorsiflexion. Conversely the ankle joint is weakest during plantarflexion (when the narrower part of the talus is in the joint) and it is in this position that the majority of ankle injuries occur – usually as a result of the sudden inversion of the foot.

Ligaments

The ankle joint is supported on each side by the medial (deltoid) and lateral collateral ligaments.

The large strong deltoid ligament is triangular in shape, attached proximally to the medial malleolus at its apex and its broad base attached distally to a line that extends from the tuberosity of the navicular bone anteriorly to the medial tubercle of the talus posteriorly. The medial ligament is subdivided into four parts: the tibionavicular part, the tibiocalcaneal part, the posterior tibiotalar part and the anterior tibiotalar part. It acts to prevent overeversion of the foot and helps maintain the medial longitudinal arch.

The weaker lateral ligament is actually composed of three separate ligaments all originating from the lateral malleolus; the anterior talofibular ligament (attaching to the anterior talus), the posterior talofibular ligament (attaching to the posterior talus) and the calcaneofibular ligament (attaching to the calcaneus). It resists inversion of the foot and is frequently injured in ankle sprain inversion injuries. The most commonly affected ligament is the anterior talofibular ligament followed by the calcaneofibular ligament and then the posterior talofibular ligament.



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Joint movements

The ankle joint allows dorsiflexion and plantarflexion of the foot.

Movement	Muscles Involved
Dorsiflexion	Tibialis anterior, Extensor hallucis longus, Extensor digitorum longus, Fibularis tertius
Plantarflexion	Gastrocnemius, Plantaris, Soleus, Flexor hallucis longus, Tibialis posterior, Fibularis longus

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Anatomy: Leg and Foot



Question 98 of 110

The calcaneus bone articulates with which of the following bones:

a The talus and the navicular

b The talus and the cuboid

c The talus and the tibia

d The talus, the navicular and the cuboid

e The talus, the tibia and the fibula

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Question 98 of 110

The calcaneus bone articulates with which of the following bones:

a) **The talus and the navicular** ✗
b) The talus and the cuboid ✓
c) The talus and the tibia
d) The talus, the navicular and the cuboid
e) The talus, the tibia and the fibula

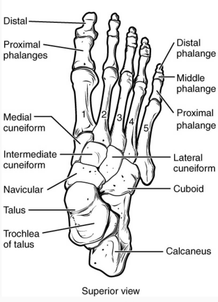
Answer

The calcaneus articulates with the talus superiorly and the cuboid anteriorly.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

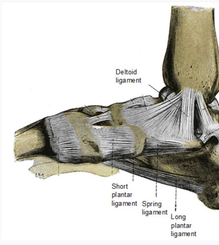
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

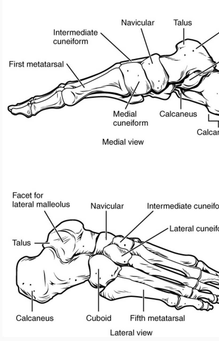
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 99 of 110

Regarding the ligaments of the knee, which of the following statements is CORRECT:

a The oblique popliteal ligament is an extension of the tendon of the biceps femoris.

b The oblique popliteal ligament reinforces the joint capsule anteriorly.

c Injury to the tibial collateral ligament is usually associated with a medial meniscus tear.

d The patella ligament is attached to the fibular head distally.

e The patella ligament is the distal portion of the oblique popliteal ligament.

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Anatomy: Leg and Foot

Question 99 of 110

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b) The oblique popliteal ligament reinforces the joint capsule anteriorly.
c)
Injury to the tibial collateral ligament is usually associated with a medial meniscus tear.
d) The patella ligament is attached to the fibular head distally.
e) The patella ligament is the distal portion of the oblique popliteal ligament.

Answer

The oblique popliteal ligament is an extension of the semimembranosus tendon reinforces the joint capsule posteromedially. The patella ligament is a continuation of the quadriceps femoris tendon and attaches to the tibia distally. The tibial collateral ligament is attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

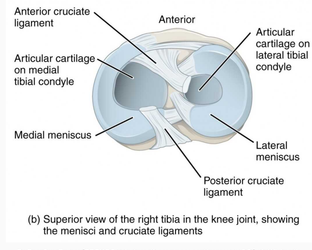
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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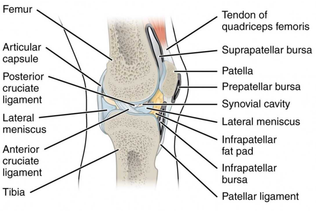
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 100 of 110

Contraction of the popliteus muscle in initiation of knee flexion produces which of the following actions:

a Draws the femur anteriorly on the tibial plateaus

b Draws the lateral meniscus posteriorly

c Medially rotates the femur on the tibial plateaus

d Draws the medial meniscus posteriorly

e Draws the lateral meniscus anteriorly

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a) Draws the femur anteriorly on the tibial plateaus
b) Draws the lateral meniscus posteriorly ✔
c) **Medially rotates the femur on the tibial plateaus** ✖
d) Draws the medial meniscus posteriorly
e) Draws the lateral meniscus anteriorly

Answer

The popliteus muscle is attached to the lateral meniscus in the knee and draws it posteriorly during knee flexion thus preventing its entrapment.

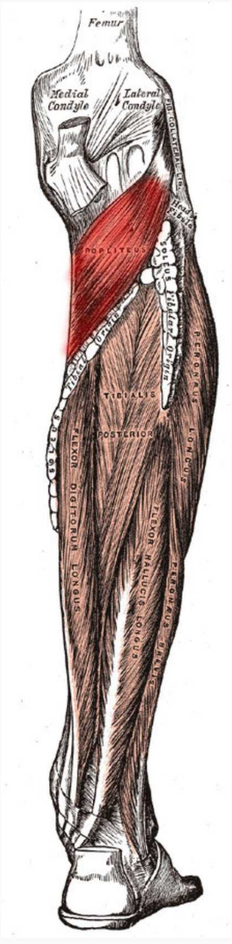
Notes

The popliteus muscle is the smallest and most superior of the deep muscles in the posterior compartment of the leg.

The popliteus muscle 'unlocks' the knee from the fully extended 'locked' position by initiating lateral rotation of the femur on the fixed tibia and hences assists in initiation of flexion of the leg at the knee joint. It stabilises the knee by resisting lateral rotation of the tibia on the femur.

The popliteus muscle is also attached to the lateral meniscus in the knee and draws it posteriorly during knee flexion thus preventing its entrapment.

The popliteus is innervated by the tibial nerve (L4 – S1).



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Question 101 of 110

A 21 year old man dropped a knife which penetrated the dorsum of his foot. He complains of loss of sensation over the webspace between the 1st and 2nd toes. Which of the following nerves has most likely been damaged:

a Superficial fibular nerve

b Deep fibular nerve

c Sural nerve

d Tibial nerve

e Saphenous nerve

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Question 101 of 110

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a) Superficial fibular nerve
b) **Deep fibular nerve** ✔
c) Sural nerve
d) Tibial nerve
e) Saphenous nerve

Answer

The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.

Notes

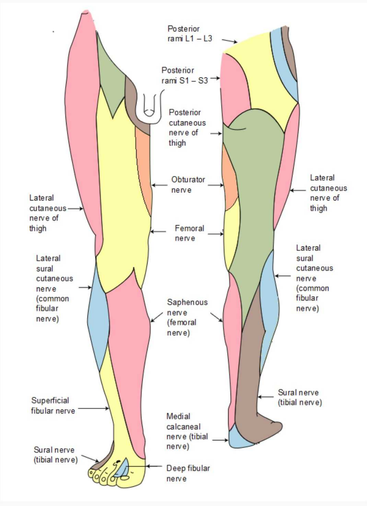
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

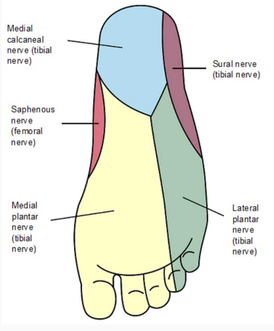
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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A 28 year old woman is unable to invert her foot after sustaining an injury to her leg playing water-polo. Which of the following nerves are most likely damaged:

a Tibial and superficial fibular nerve

b Deep and superficial fibular nerve

c Tibial and deep fibular nerve

d Tibial and saphenous nerve

e Tibial and obturator nerve

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c) **Tibial and deep fibular nerve** ✔
d) Tibial and saphenous nerve
e) Tibial and obturator nerve

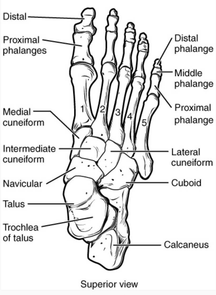
Answer

Inversion of the foot is primarily produced by the tibialis anterior and the tibialis posterior, innervated by the deep fibular nerve and the tibial nerve respectively.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

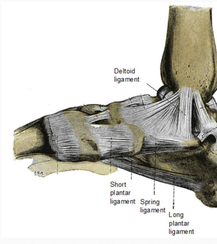
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

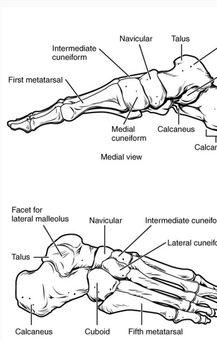
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 103 of 110

The skin over the webspace between the 1st and 2nd toe is supplied by which of the following nerves:

a Sural nerve

b Deep fibular nerve

c Tibial nerve

d Saphenous nerve

e Superficial fibular nerve

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Anatomy: Leg and Foot

Question 103 of 110

The skin over the webspace between the 1st and 2nd toe is supplied by which of the following nerves:

a) Sural nerve
b) **Deep fibular nerve** ✔
c) Tibial nerve
d) Saphenous nerve
e) Superficial fibular nerve

Answer

The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.

Notes

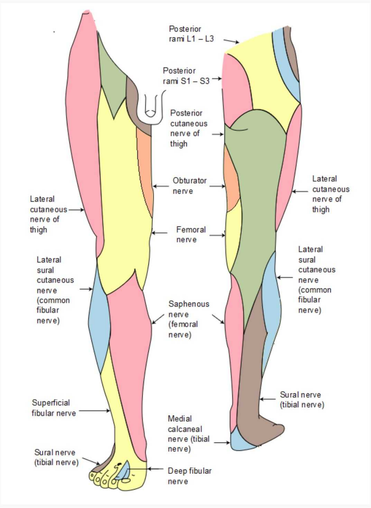
Nerve	Origin	Skin supplied
Lateral cutaneous nerve of thigh	Lumbar plexus (L2, L3)	Lateral thigh
Anterior cutaneous nerve	Femoral nerve	Anterior thigh and anteromedial knee
Cutaneous branch	Obturator nerve	Medial thigh
Posterior cutaneous nerve of thigh	Sacral plexus (S1 – S3)	Posterior thigh and upper leg
Saphenous nerve	Femoral nerve	Anteromedial knee, medial leg and foot
Lateral sural cutaneous nerve	Common fibular nerve	Upper lateral leg
Superficial fibular nerve	Common fibular nerve	Lower anterolateral leg and dorsum of foot
Deep fibular nerve	Common fibular nerve	Webspace between 1st and 2nd toe
Sural nerve	Tibial nerve	Lower posterolateral leg, heel and foot
Medial calcaneal nerve	Tibial nerve	Medial side and sole of heel
Medial and lateral plantar nerves	Tibial nerve	Sole of foot anterior to heel

Thigh:

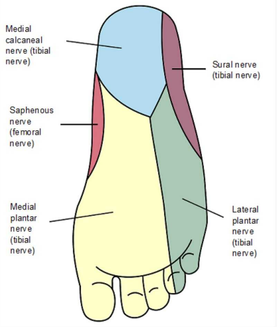
- The skin over the hip and gluteal region is supplied by the posterior and anterior rami of lumbosacral nerves (L1 – S3).
- The lateral cutaneous nerve of the thigh, nerve from the lumbar plexus, supplies skin over the lateral thigh.
- The anterior cutaneous nerve, branch of the femoral nerve, supplies skin over the anterior thigh and anteromedial knee.
- The obturator nerve supplies skin over the upper medial thigh.
- The posterior cutaneous nerve of the thigh, nerve from the sacral plexus, supplies skin over the posterior thigh and upper leg.

Leg:

- The saphenous nerve, branch of the femoral nerve, supplies the skin over the anteromedial knee, medial leg and the medial side of the foot as far anteriorly as the head of the 1st metatarsal.
- The lateral sural nerve, branch of the common fibular nerve, supplies the skin over the upper lateral leg.
- The superficial fibular nerve supplies the area of skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd toe and the lateral side of the little toe).
- The deep fibular nerve supplies the skin over the webspace between the 1st and 2nd toe.
- The sural nerve, branch of the tibial nerve, supplies the skin over the lower posterolateral leg, heel and foot.
- The medial calcaneal nerve, branch of the tibial nerve, supplies the skin over the medial side and sole of the heel.
- The medial and lateral plantar nerves, branches of the tibial nerve, supply the skin over the sole of the foot anterior of the heel.



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Anatomy: Leg and Foot



Question 104 of 110

A 54 year old woman presents to ED complaining of pain and swelling behind her knee, and difficulty walking. Imaging shows a large cyst in the popliteal fossa compressing the tibial nerve. Which of the following movements will most likely be affected:

a Extension of the leg at the knee

b Flexion of the thigh at the hip

c Extension of the toes

d Dorsiflexion at the ankle

e Plantarflexion at the ankle

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Anatomy: Leg and Foot

Question 104 of 110

A 54 year old woman presents to ED complaining of pain and swelling behind her knee, and difficulty walking. Imaging shows a large cyst in the popliteal fossa compressing the tibial nerve. Which of the following movements will most likely be affected:

a) Extension of the leg at the knee
b) Flexion of the thigh at the hip
c) Extension of the toes
d) Dorsiflexion at the ankle
e) **Plantarflexion at the ankle** ✔

Answer

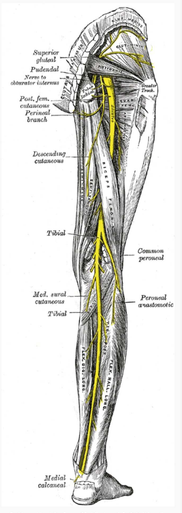
The tibial nerve innervates the muscles in the posterior leg, which are mainly responsible for plantarflexion of the foot at the ankle and flexion of the toes. The tibialis posterior muscle is also involved in inversion of the foot and the gastrocnemius and plantaris muscles in flexion of the leg at the knee. Extension of the leg at the knee is mainly a function of the quadriceps femoris muscles, innervated by the femoral nerve. Extension of the toes and dorsiflexion of the foot is produced by muscles in the anterior leg, innervated by the deep fibular nerve.

Notes

The tibial nerve is a branch of the sciatic nerve receiving nerve fibres from L4 – S3.

Nerve	Tibial nerve
Nerve roots	L4 – S3
Motor supply	All muscles in the posterior compartment of the leg and the intrinsic muscles in the sole of the foot
Sensory supply	Skin on the posterolateral side of the lower leg, the lateral side of the ankle, foot and little toe, the medial side of the heel and the sole of the heel, foot and toes
Injury	Weakness of flexion of knee, loss of plantarflexion of ankle and flexion of toes, weakness of foot inversion and loss of sensation in distribution above

It arises at the apex of the popliteal fossa before descending in the leg to enter the popliteal fossa posterior to the knee. The tibial nerve then passes under the tendinous arch formed by the two heads of the soleus muscle and then descends through the deep region of the posterior compartment of the leg. The tibial nerve passes through the tarsal tunnel, posterior to the medial malleolus to enter to foot.

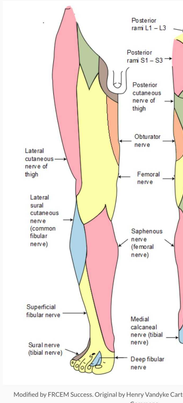


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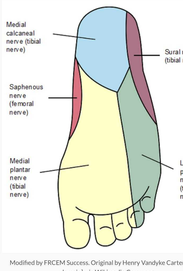
Through its muscular branches, the tibial nerve innervates all of the muscles in the posterior compartment of the leg. The tibial nerve gives rise to the sural nerve in the proximal leg which supplies skin on the lower posterolateral surface of the leg, and the lateral side of the ankle, foot and little toe, and the medial calcaneal nerve in the distal leg which supplies skin on the medial surface and sole of the heel. In the foot the tibial nerve divides into the medial and lateral plantar nerves which innervate all of the intrinsic muscles of the sole of the foot and supply skin over the medial and lateral sole of foot and toes respectively.

Branch	Innervation
Muscular branches	Posterior compartment of leg
Sural nerve	Skin on lower posterolateral leg, lateral side of ankle, foot and little toe
Medial calcaneal nerve	Skin on medial surface and sole of heel
Plantar nerves	Intrinsic muscles in sole of foot, skin over sole of foot and toes

Muscle	Action(s)
Gastrocnemius	Plantarflexion of foot and flexion of leg
Plantaris	Plantarflexion of foot and flexion of leg
Soleus	Plantarflexion of foot
Flexor digitorum longus	Flexion of lateral four toes
Flexor hallucis longus	Flexion of great toe and plantarflexion of foot
Tibialis posterior	Plantarflexion and inversion of foot, support of medial arch



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Anatomy: Leg and Foot



Question 105 of 110

A 42 year old carpet layer, who spends a lot of time working on his hands and knees, presents to ED complaining of a painful knee. On examination there is a tender swelling over the patella. You suspect housemaid's knee. Which of the following bursa is most likely inflammed:

a Pretibial bursa

b Suprapatellar bursa

c Subcutaneous infrapatellar bursa

d Deep infrapatellar bursa

e Prepatellar bursa

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Anatomy: Leg and Foot

Question 105 of 110

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a) **Pretibial bursa** ✗
b) Suprapatellar bursa
c) Subcutaneous infrapatellar bursa
d) Deep infrapatellar bursa
e) Prepatellar bursa ✓

Answer

Housemaid's knee is inflammation of the prepatellar bursa, occurring most commonly in people who spend a long time working on their hands and knees, for example plumbers, roofers, carpet layers, cleaners and gardeners. Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa and occurs most commonly in people who spend a long time kneeling, for example clergymen when praying.

Notes

Joint	Knee joint
Type	Modified hinge synovial joint
Articulations	Femoral condyles with tibial condyles (tibiofemoral articulation) and patella with anterior femur (patellofemoral articulation)
Stabilising factors	Fibrous capsule, tibial spines, menisci, tibial/fibular collateral ligament, anterior/posterior cruciate ligament, vastus medialis and lateralis muscles, oblique popliteal ligament, iliotibial tract, muscle tendons (hamstrings, gastrocnemius, sartorius, gracilis)
Movements	Flexion/Extension, Medial/Lateral rotation in flexed position

Joint articulations

The knee joint is formed from two articulations:

- the main weight bearing tibiofemoral articulation between the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles
- the patellofemoral articulation between the anterior femur and the patella which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear

Joint movements

The knee joint is a modified hinge synovial joint, allowing mainly flexion and extension, but also a small degree of medial and lateral rotation.

Movement	Muscles Involved
Flexion	Hamstrings, Gracilis, Sartorius, Gastrocnemius, Plantaris
Extension	Quadriceps femoris

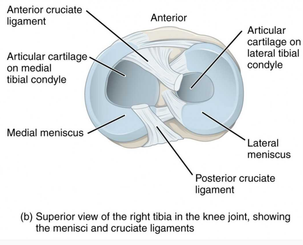
When standing, the knee joint is 'locked' in position to reduce the amount of muscle work needed to maintain the standing weight bearing position. This locking mechanism occurs partly due to the change in the shape/size of the articulating femoral surfaces (in the flexed position, the surfaces of the femoral condyles that articulate with the tibia are curved/round, but in extension, the surfaces are flat, and consequently the joint surfaces become larger and more stable in extension) and partly due to medial rotation of the femur on the tibia in full extension; medial rotation and full extension tightens all the associated ligaments (the screw home mechanism). Contraction of the popliteus muscle 'unlocks' the knee by initiating lateral rotation of the femur on the tibia, and allowing flexion.

Joint capsule

The fibrous membrane of the knee joint is reinforced anteriorly by the tendinous expansions of the vastus lateralis and vastus medialis muscles, anterolaterally by a fibrous extension from the iliotibial tract and posteromedially by the oblique popliteal ligament, an extension from the tendon of the semimembranosus muscle (the oblique popliteal ligament resists hyperextension and lateral rotation of the leg). The upper end of the popliteus muscle passes through an opening in the posterolateral aspect of the fibrous membrane of the knee.

Menisci

The two menisci are C-shaped fibrocartilaginous structures that lie between the femoral condyles and the tibia, attaching at each end to facets in the intercondylar region of the tibial plateau. In addition, the medial meniscus is also attached around its margin to the joint capsule and to the tibial collateral ligament, unlike the smaller, more mobile lateral meniscus. This means any damage to the tibial collateral ligament results in tearing of the medial meniscus. The menisci deepen the articular surface of the tibia increasing stability of the joint, improve congruence between the femoral and tibial condyles during joint movements and play an important role in shock absorption.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

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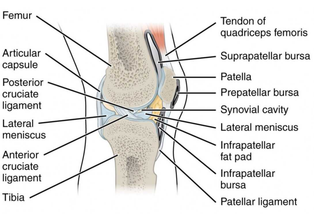
Ligaments

The tibial collateral ligament is attached proximally to the medial epicondyle of the femur and distally to the medial tibia. The fibular collateral ligament is attached proximally to the lateral condyle of the femur and distally to the lateral fibula. The tibial and fibular collateral ligaments act to stabilise the knee joint medially and laterally respectively, limiting extension and preventing adduction and abduction movements. The tibial collateral ligament is also attached to the medial meniscus; this means any damage to the tibial collateral ligament usually results in tearing of the medial meniscus.

The cruciate ligaments interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

- The anterior cruciate ligament (the weaker of the two) attaches to the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to the lateral wall of the intercondylar fossa of the femur and acts to prevent anterior displacement of the tibia relative to the femur. The ligament is lax during flexion and taut during extension thus it may be torn when the knee is hyperextended (or by the application of a large force to the back of the knee with the joint partly flexed). The anterior drawer sign may be seen where there is forward sliding of the tibia on the femur.
- The posterior cruciate ligament (the stronger of the two) attaches to the posterior part of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur and acts to prevent posterior dislocation of the tibia relative to the femur. The ligament is lax during extension and taut during flexion and thus it may be torn in a hyperflexion injury, where a large force is applied to the tibia when the knee is flexed. The posterior drawer sign may be seen where there is backward sliding of the tibia on the femur.

The 'unhappy triad' typically occurs due to a lateral force to an extended knee, e.g. in a football tackle. It refers to injury of the anterior cruciate ligament (due to forward displacement of the tibia), the tibial collateral ligament (due to excessive abduction) and the medial meniscus (due to its attachment on the tibial collateral ligament).



(a) Sagittal section through the right knee joint

Bursae

The synovial membrane of the knee joint forms pouches in two locations to provide low-friction surfaces for the movement of tendons associated with the joint:

- The subpopliteal recess – extends posterolaterally and lies between the lateral meniscus and the tendon of the popliteus muscle
- The suprapatellar bursa extends superiorly between the distal end of the shaft of the femur and the quadriceps femoris muscle and tendon

Other bursae associated with the knee, but not normally communicating with the synovial joint, include the subcutaneous prepatellar bursa, the deep and subcutaneous infrapatellar bursae separated by the patella ligament, and numerous other bursae associated with tendons and ligaments around the knee joint. Housemaid's knee is inflammation of the prepatellar bursa, and Clergyman's knee is inflammation of the subcutaneous infrapatellar bursa.

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Anatomy: Leg and Foot



Question 106 of 110

A 25 year old cyclist is knocked off his bike by a car. He complains of weakness of plantarflexion and inversion of his foot. Which of the following muscles has likely been damaged:

a Tibialis anterior

b Tibialis posterior

c Fibularis longus

d Plantaris

e Soleus

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Anatomy: Leg and Foot

Question 106 of 110

A 25 year old cyclist is knocked off his bike by a car. He complains of weakness of plantarflexion and inversion of his foot. Which of the following muscles has likely been damaged:

a) Tibialis anterior
b) **Tibialis posterior** ✔
c) Fibularis longus
d) Plantaris
e) Soleus

Answer

The tibialis posterior acts to plantarflex and invert the foot. The tibialis anterior acts to dorsiflex and invert the foot. The fibularis longus acts to evert the foot. The gastrocnemius and soleus both assist with plantarflexion but not inversion.

Notes

The muscles of the posterior leg are divided into the superficial group (the gastrocnemius, the plantaris and the soleus) and the deep group (the popliteus, the flexor hallucis longus, the flexor digitorum longus and the tibialis posterior). They are all innervated by the tibial nerve.

Muscle	Action(s)	Innervation
Gastrocnemius (green)	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Plantaris	Plantarflexion of foot and flexion of leg	Tibial nerve (S1, S2)
Soleus (red)	Plantarflexion of foot	Tibial nerve (S1, S2)
Flexor digitorum longus (green)	Flexion of lateral four toes	Tibial nerve (S2, S3)
Flexor hallucis longus (blue)	Flexion of great toe and plantarflexion of foot	Tibial nerve (S2, S3)
Tibialis posterior (red)	Plantarflexion and inversion of foot, support of medial arch	Tibial nerve (L4, L5)

The gastrocnemius plantarflexes the foot at the ankle and also flexes the leg at the knee.

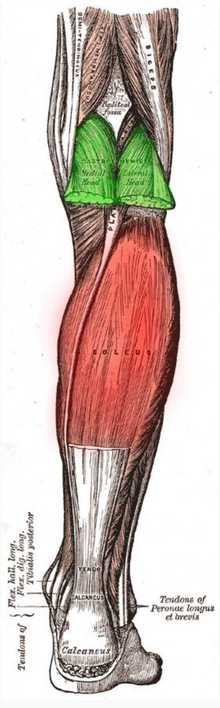
The plantaris plantarflexes the foot at the ankle and flexes the leg at the knee.

The soleus plantarflexes the foot at the ankle.

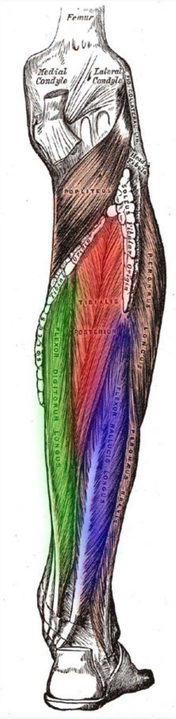
The flexor digitorum longus flexes the lateral four toes. It is involved with gripping the ground during walking and propelling the body forward off the toes at the end of the stance phase of gait.

The flexor hallucis longus flexes the great toe and contributes to plantarflexion of the foot at the ankle joint.

The tibialis posterior inverts and plantarflexes the foot and provides dynamic support to the medial arch of the foot during walking. The tibialis posterior distally curves forward under the medial malleolus and enters the medial side of the foot to attach to the medial tarsal bones, mainly to the tuberosity of the navicular and adjacent region of the medial cuneiform.



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Anatomy: Leg and Foot



Question 107 of 110

Which of the following structures primarily supports the medial longitudinal arch rather than the lateral longitudinal arch of the foot:

a Short muscles of the little toe

b Tibialis posterior tendon

c Long plantar ligament

d Short plantar ligament

e Fibularis longus tendon

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Anatomy: Leg and Foot

Question 107 of 110

Which of the following structures primarily supports the medial longitudinal arch rather than the lateral longitudinal arch of the foot:

a) Short muscles of the little toe
b) **Tibialis posterior tendon** ✔
c) Long plantar ligament
d) Short plantar ligament
e) Fibularis longus tendon

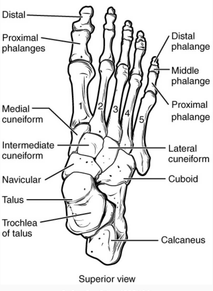
Answer

The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.

Notes

Tarsal bones

There are three groups of bones in the foot: the seven tarsal bone, the five metatarsal bones and the fourteen phalanges. The tarsal bones are organised into three rows, the proximal group (talus and calcaneus), the intermediate navicular bone and the distal group (cuboid and three cuneiforms).



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Tarsal Bone	Articulations
Talus	Tibia and fibula superiorly, calcaneus inferiorly and navicular anteriorly
Calcaneus	Talus superiorly and cuboid anteriorly
Navicular	Talus posteriorly and cuboid and three cuneiforms anteriorly
Cuboid	Calcaneus and navicular posteriorly, lateral cuneiform medially and bases of lateral two metatarsals anteriorly
Lateral cuneiform	Navicular posteriorly, cuboid laterally and 3rd metatarsal anteriorly
Intermediate cuneiform	Navicular posteriorly and 2nd metatarsal anteriorly
Medial cuneiform	Navicular posteriorly and 1st metatarsal anteriorly

Intertarsal joints

There are numerous synovial joints between the individual tarsal bones which allow movements of the foot, the most important of these being:

- the subtalar joint (between the inferior surface of the talus and the superior surface of the calcaneus)
- the talocalcaneonavicular (between the head of the talus and the calcaneus and spring ligament below, and the navicular in front)
- the calcaneocuboid joints (between the anterior calcaneus and the posterior cuboid)

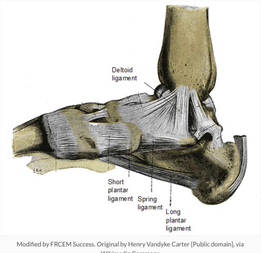
Joint movements

The talocalcaneonavicular joint and the calcaneocuboid joints are together often referred to as the transverse tarsal joint. The subtalar and transverse tarsal joints allow inversion and eversion of the foot.

Movement	Muscles Involved
Inversion	Tibialis anterior and posterior
Eversion	Fibularis longus, brevis and tertius

Ligaments

The spring ligament (plantar calcaneonavicular ligament) is a broad thick ligament that extends from the calcaneus to the navicular bone. It supports the head of the talus, stabilises the talocalcaneonavicular joint and resists depression of the medial arch of the foot. The spring ligament takes the weight of the body from the talus and transmits it to the forefoot.



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Foot arches

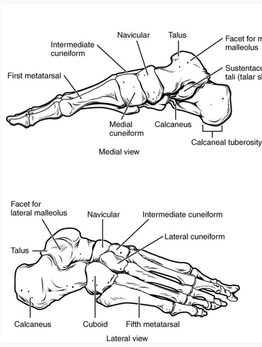
The bones of the foot form longitudinal and transverse arches (relative to the ground) which absorb and distribute weight bearing forces during standing and moving.

The longitudinal arch is formed between the posterior end of the calcaneus and the heads of the metatarsals and has a medial and lateral part.

Arch	Formed by carpal bones	Prime supporting factors
Medial longitudinal arch	Calcaneus, talus, navicular, three cuneiforms and medial three metatarsal bones	Spring ligament, deltoid ligament, plantar aponeurosis and tendons of the tibialis anterior and tibialis posterior muscles
Lateral longitudinal arch	Calcaneus, cuboid and lateral two metatarsal bones	Plantar aponeurosis, fibularis longus tendon, long and short plantar ligament

The higher medial longitudinal arch is formed and maintained by the interlocking of the calcaneus, the talus, the navicular, the three cuneiforms and the medial three metatarsal bones. The medial longitudinal arch is supported by the spring ligament, the deltoid ligament, the plantar aponeurosis, the small muscles in the sole of the foot and the tendons of the tibialis anterior, tibialis posterior and flexor hallucis longus muscles which provide passive and dynamic support.

The lateral longitudinal arch is formed from the calcaneus, the cuboid and the lateral two metatarsal bones. The lateral longitudinal arch is flatter than the medial part and rests on the ground during standing. The lateral longitudinal arch is supported by the the long and short plantar ligament and the fibularis longus tendon together with the extensor tendons and the short muscles of the little toe.



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Anatomy: Leg and Foot



Question 108 of 110

You are performing a vascular examination on a patient with suspected claudication. The posterior tibial artery pulse is best palpated at which of the following sites:

a Posterior and inferior to the medial malleolus

b Anterior to the medial malleolus

c Posterior and inferior to the lateral malleolus

d Anterior to the lateral malleolus

e Just superior to the medial malleolus

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Anatomy: Leg and Foot

Question 108 of 110

You are performing a vascular examination on a patient with suspected claudication. The posterior tibial artery pulse is best palpated at which of the following sites:

a) Posterior and inferior to the medial malleolus ✔
b) Anterior to the medial malleolus
c) Posterior and inferior to the lateral malleolus
d) Anterior to the lateral malleolus
e) Just superior to the medial malleolus

Answer

The posterior tibialis pulse may be palpated posterior and inferior to the medial malleolus, midway between the medial malleolus and the heel.

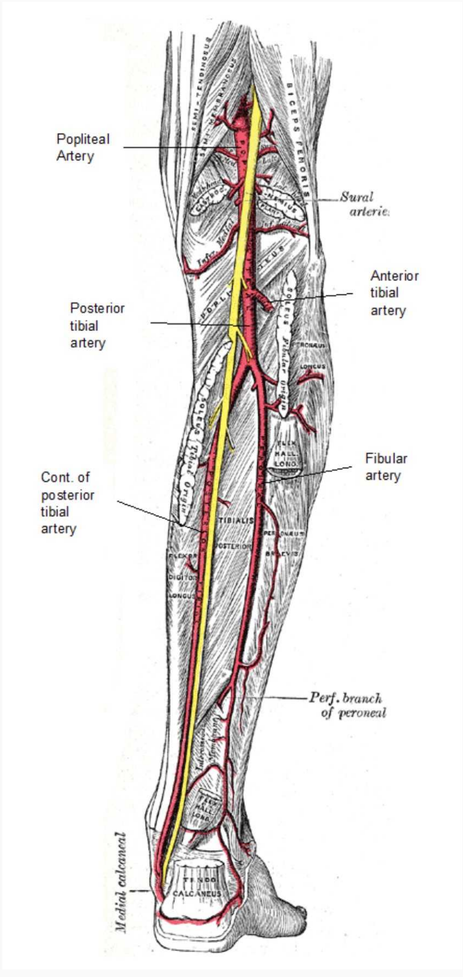
Notes

After exiting the popliteal fossa between the gastrocnemius and popliteus muscle, the popliteal artery bifurcates into the anterior and posterior tibial arteries at the lower border of the popliteus.

The anterior tibial artery penetrates the interosseous membrane to enter and supply the anterior compartment of the leg, continuing inferiorly into the foot where it becomes the dorsalis pedis artery.

The posterior tibial artery descends through the deep region of the posterior compartment of the leg, giving rise to its two major branches, the circumflex fibular artery and the fibular artery and supplying the posterior and lateral compartments of the leg before passing posterior to the medial malleolus, and entering the sole of the foot via the tarsal tunnel.

The posterior tibialis pulse may be palpated posterior and inferior to the medial malleolus, midway between the medial malleolus and the heel.



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Anatomy: Leg and Foot



Question 109 of 110

A patient receives a deep laceration to his left leg while trying to escape an angry farmer through a barbed-wire fence. He is unable to dorsiflex his foot. Sensation is normal over the dorsum of the foot. Which of the following nerves has most likely been injured:

a Common fibular nerve

b Sural nerve

c Deep fibular nerve

d Superficial fibular nerve

e Tibial nerve

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Anatomy: Leg and Foot

Question 109 of 110

A patient receives a deep laceration to his left leg while trying to escape an angry farmer through a barbed-wire fence. He is unable to dorsiflex his foot. Sensation is normal over the dorsum of the foot. Which of the following nerves has most likely been injured:

a) Common fibular nerve
b) Sural nerve
c) **Deep fibular nerve** ✔
d) Superficial fibular nerve
e) Tibial nerve

Answer

The deep fibular nerve innervates the muscles in the anterior compartment of the leg which are responsible for dorsiflexion of the foot and extension of the toes. Sensation to the dorsum of the foot is most supplied by the superficial fibular nerve (except for the webspace between the 1st and 2nd toes, which is supplied by the deep fibular nerve).

Notes

The deep fibular nerve is a branch of the common fibular nerve and receives nerve fibres from the nerve roots of L4 – L5.

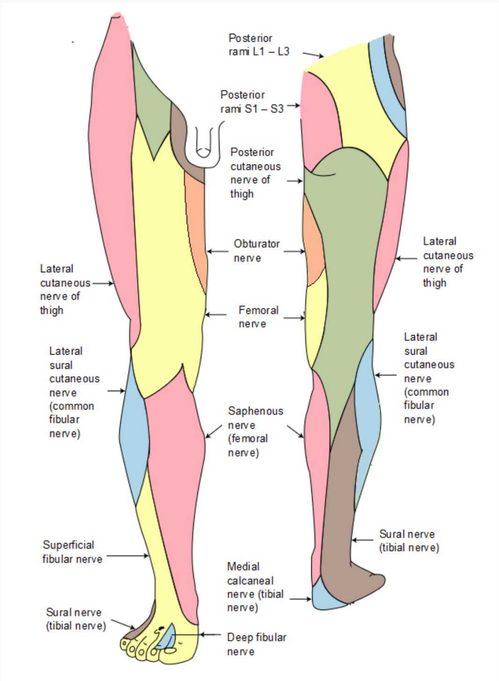
Nerve	Deep fibular nerve
Nerve roots	L4 -L5
Motor supply	Anterior compartment of leg
Sensory supply	Webspace between 1st and 2nd toes
Injury	Loss of dorsiflexion of ankle and extension of toes, foot drop with high-stepping gait, weakness of foot inversion, loss of sensation over webspace between 1st and 2nd toes

It innervates the anterior leg (tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius) and the dorsal intrinsic muscles of the foot. It supplies skin over the webspace between the 1st and 2nd toes.

Motor supply

Muscle	Action(s)
Tibialis anterior	Dorsiflexion and inversion of foot, support of medial arch of foot
Extensor hallucis longus	Extension of great toe and dorsiflexion of foot
Extensor digitorum longus	Extension of lateral four toes and dorsiflexion of foot
Fibularis tertius	Dorsiflexion and eversion of foot

Sensory supply



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Anatomy: Leg and Foot



Question 110 of 110

The superficial fibular nerve supplies which of the following areas of skin:

a Posterolateral leg and heel

b Anterolateral lower leg and dorsum of foot

c Anteromedial lower leg and dorsum of foot

d Lateral upper leg and dorsum of foot

e Anterolateral lower leg and heel

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Anatomy: Leg and Foot

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The superficial fibular nerve supplies which of the following areas of skin:

a) Posterolateral leg and heel
b) **Anterolateral lower leg and dorsum of foot** ✔
c) Anteromedial lower leg and dorsum of foot
d) Lateral upper leg and dorsum of foot
e) Anterolateral lower leg and heel

Answer

The superficial fibular nerve supplies skin over the lower anterolateral leg and the dorsum of the foot (except for the lateral side of the little two, and the webspace between the 1st and 2nd toe).

Notes

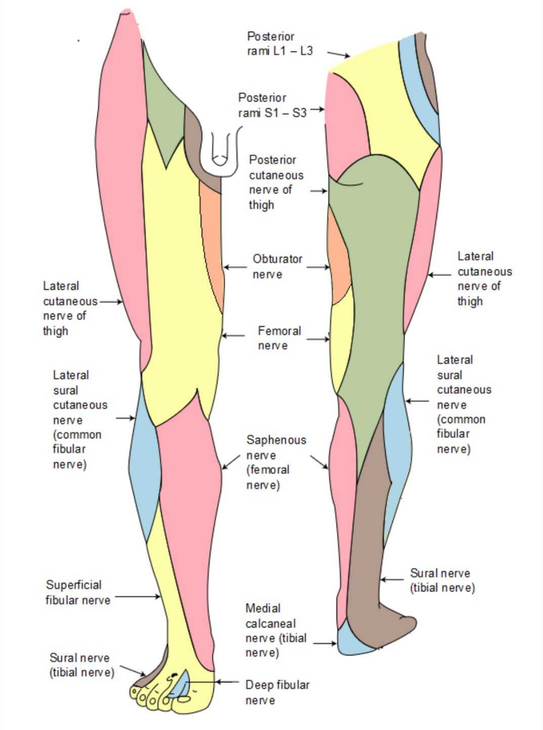
The superficial fibular nerve is a branch of the common fibular nerve and receives nerve fibres from L4 – S1.

Nerve	Superficial fibular nerve
Nerve roots	L4 – S1
Motor supply	Lateral compartment of leg
Sensory supply	Lower anterolateral leg and dorsum of foot
Injury	Loss of eversion of the foot and loss of sensation over the lower anterolateral leg and dorsum of foot

It innervates the fibularis longus and the fibularis brevis in the lateral leg. It supplies the skin over the lower anterolateral leg and the dorsum of the foot (except for the webspace between the 1st and 2nd digit supplied by the deep fibular nerve, and the lateral side of the little toe, supplied by the sural branch of the tibial nerve).

Motor supply

Muscle	Action(s)
Fibularis longus	Plantarflexion and eversion of foot, support of lateral and transverse arch
Fibularis brevis	Eversion of foot



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